DOCUMENT RESUME

ED 292 769	SP 030 001
TITLE	Introductory Principles of Nutrition: Course Outline and Instructor's Manual.
INSTITUTION	North Carolina State Dept. of Public Instruction, Raleigh.
PUB DATE	87
NOTE	136p.
AVAILABLE FROM	The Division of Child Nutrition, North Carolina Dept. of Public Instruction, Education Building, Annex I, 217 West Jones Street, Raleigh, NC 27603.
PUB TYPE	Guides - Classroom Use - Guides (For Teachers) (052)
EDRS PRICE	MF01/PC06 Plus Postage.
DESCRIPTORS	*Dietetics; Eating Habits; Elementary Secondary Education; *Health Education; Inservice Teacher Education; *Nutrition Instruction; Videotape Recordings

ABSTRACT

This introductory level course for educators combines factual nutrition information with issues on controversies that surround the topics. It was developed to provide teachers and curriculum specialists with special training in nutrition and to strengthen their skills in teaching basic nutrition concepts to students. The course is designed to be presented with televised videotape recordings. Each chapter of the outline represents a video lesson and contains the following: (1) a foreword or introductory chapter; (2) student objectives; (3) identification of text assignments; (4) a lesson outline; and (5) course outline assignments. Recommendations are offered for completing each lesson. The unit includes an instructor's manual. (JD)

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ED 292 769

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Introductory Principles of Nutrition

Course Outline

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DIVISION OF CHILD NUTRITION
NORTH CAROLINA DEPARTMENT OF PUBLIC INSTRUCTION

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INTRODUCTORY PRINCIPLES OF NUTRITION

COURSE OUTLINE

DIVISION OF CHILD NUTRITION

NUTRITION EDUCATION AND TRAINING PROGRAM
Division of Child Nutrition
Department of Public Instruction
Raleigh, NC
1987

The Nutrition Education and Training Program of the Department of Public Instruction, Division of Child Nutrition, is available to all individuals regardless of race, color, national origin, religion, age, sex, or handicap. Persons who believe they have been denied opportunity for participation may write to the Secretary of Agriculture, Washington, D. C. 20250.

This project was funded by the Division of Child Nutrition, North Carolina Department of Public Instruction under the Nutrition Education and Training Program.

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FOREWORD

The North Carolina Department of Public Instruction, Division of Child Nutrition, receives funds under Public Law 95-166 to conduct the Nutrition Education and Training (NET) Program in school systems throughout the state. The overall goals of the Division of Child Nutrition are to promote nutrition education and to safeguard the health and well-being of the children of North Carolina. To help achieve these goals, a course outline has been developed to accompany the Introductory Principles of Nutrition series.

Teachers of the basic core subjects, including health, mathematics, science, social studies, language arts, and other subjects, such as physical education and home economics, have the responsibility of helping students learn the basic principles of nutrition so that they will become wise food consumers and understand the important relationship between nutrition and health. The course outline was developed to provide teachers with special training in nutrition and to strengthen their skills in teaching basic nutrition concepts to students. It provides an update on the developments and advances in the field of nutrition, thus allowing teachers to provide students with the most current information.

A. Craig Phillips
State Superintendent of Public Instruction

Theodore R. Drain
Assistant State Superintendent, Support Services

INTRODUCTION

This course is an introductory level nutrition course for educators responsible for incorporating nutrition education into the curriculum of the North Carolina Public Schools. The course presentation combines several teaching techniques including videotape viewing, instructor guided discussions and activities, text assignments, and study guide assignments. It is hoped that this multi-faceted approach will provide for optimal learning outcomes.

This course combines factual nutrition information with issues on controversies that surround the topics. The factual information must first be mastered; then the controversies can be explored. Television has been chosen as the medium for delivering this course for two reasons. First, it is one way to bring a college professor to any school system choosing to sponsor the course, and second, the videotaped presentations use elaborate visuals that may not be available to all instructors.

The video to be used in the course is entitled "Introductory Principles of Nutrition." This series of films was developed by Pennsylvania State University, College of Human Development, Nutrition Department, for televised instruction. The text to be used along with the video is Nutrition: Concepts and Controversies by Eva May Hamilton, Eleanor Whitney and Frances Sizer. The Study Guide to accompany Nutrition: Concepts and Controversies, written by Agnes Hartwell and Sharon Rolfes, will be used to reinforce information presented in the text. The Course Outline provides learning activities which combine information from the video presentations and text material. The outline should be used in the conjunction with the THIRD EDITION of Nutrition: Concepts and Controversies.

Students should become familiar with the format of the Course Outline before proceeding with the course. Each chapter represents a video lesson and contains the following: a foreword or introductory paragraph, student objectives, identification of text assignments, a lesson outline, and course outline assignments. The following are recommendations for completing each lesson:

1. Before beginning the course:
    a. Become familiar with the format of this outline, Nutrition: Concepts and Controversies text and Study Guide.
    b. Read pages 1-7 in Nutrition: Concepts and Controversies as an introduction to nutrition.

2. Before viewing the tapes:
    a. Read the foreword and student objectives for the lesson.
    b. Read the text assignment and check through the defined terms in the glossary of each chapter.

3. While viewing the videotapes:
    a. Follow the lesson outline in the Course Outline. The outline is detailed so that the participant may give careful attention to the tapes, adding a few short notes as needed.
    b. Identify points that require discussion or clarification during class discussion.

4. During class discussion:
    a. Raise points for discussion or clarification that were presented in the videotapes.
    b. Conduct activities or discussions as led by the instructor.

5. Following class discussion:
    a. Complete the study guide assignments. These assignments are learning aids and not tests. Refer to the text, lesson outline, or notes as needed.
    b. Complete the self-test.

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SELECTING AN ADEQUATE DIET

Foreword

How do we know that the foods we consume provide us with the essential nutrients we need; that is, what is an adequate diet? This lesson presents the various dietary standards and guides that have been developed to help determine what makes an adequate diet. In particular, it examines the Recommended Dietary Allowances, table of food composition, and food group plans.

The Basic Four Food Guide has recently been modified to reflect current knowledge in nutritious meal planning. The video refers to the guide before revisions were made. The instructor will provide additional information on the revised Daily Food Guide.

Objectives

Upon completion of this lesson, which includes text assignments, video viewing, and study guide activities, the participant should be able to:

1. Identify four physiological factors that influence nutrient needs.
2. Differentiate between the Recommended Dietary Allowances (RDAs) and nutrient requirements.
3. Recognize that RDA levels change for different age/sex groups.
4. Specify at least three intended uses of the Recommended Dietary Allowances.
5. Identify the primary nutrients contributed by each of the Basic Four Food Groups.
6. State several limitations in using the Basic Four as a food guide.
7. Distinguish between enrichment and fortification as two examples of nutrient additions to the food supply.
8. Name the four enrichment nutrients found in several grains and cereal products.
9. List four examples of nutrient fortification.
10. Discuss at least two controversial issues that relate to nutrient fortification.

Chapter	Topic	Page
2	First Facts: Foods	14
3	First Facts: Nutrient Needs and Nutrition Surveys	38
3	Controversy 3: Optimal Nutrition Dietary Guidelines	57

2. Review the glossary of terms from Chapters 2 and 3 of Nutrition: Concepts and Controversies, pages 32, 55 and 56.

Optional Reading

Chapter	Topic	Pages
2	The Food Exchange System	24
11	Composition and Safety of Foods (stop at Imitation Foods)	312

Lesson Outline

I. What composes a nutritionally adequate diet?

  A. There are limitations and variables in describing adequate diets.
    1. Individual nutrient needs differ.
    2. There are gaps in current nutrition knowledge, especially in vitamins and minerals.
    3. Physical attributes of foods vary.
    4. Cultural and religious considerations, psychological meanings, and economic aspects of food differ from group to group.

  B. The same nutrients are required throughout the life cycle. Amounts needed will vary for many reasons.
    1. Age or stage in the life cycle influences nutrient requirements.
      a. During periods of growth, nutrient needs are high.
      b. Infants and young children need more nutrients per kilogram of body weight than do adults.
    2. Larger people generally require more nutrients than do smaller people.
    3. Males usually require more nutrients than females.
    4. Much individual variation exists in nutrient requirements.

II. Recommended Dietary Allowances (RDA) are suggested nutrient intakes.

  A. In 1940, the Food and Nutrition Board of the National Academy of Sciences was formed.
    1. Its purpose was to establish standards for nutrient intake for various age and sex groups.
    2. These nutrient standards are set above average group requirements.
      a. They are called allowances rather than requirements.
      b. RDAs have been set for those nutrients for which enough information exists to establish a requirement.

B. Data from several types of studies are used to determine nutrient requirements.
   1. Laboratory studies, using several species of experimental animals, are used.
   2. Surveys of large groups of individuals using clinical, biochemical, and dietary data are used to determine nutrient needs.
   3. Controlled feeding experiments with limited numbers of human subjects are also a means of assessing nutrient requirements.

C. The RDA is set two standard deviations above the mean requirement for a nutrient for any given age and sex group. Thus, an allowance for a nutrient covers approximately 97 to 98% of the need for the nutrient.

D. The RDAs are revised every five years. The most recent RDAs were published in 1980 and are shown on the inside cover of the text. Current RDAs are being reviewed but have not yet been agreed upon by the Food and Nutrition Board.

E. RDAs are based on age and sex. There are separate allowances for pregnancy and lactation.

F. RDAs are not established for all nutrients, but it is believed that if the diet furnishes adequate amounts of the nutrients for which an RDA exists, we will get enough of other nutrients. All nutritionists do not agree with this concept. This is due to the loss of nutrients caused by the refining and processing of foods.
   1. Adding nutrients back to the foods from which they were removed during processing does not necessarily correct the problem; the only nutrients added back are those for which an RDA exists.
   2. Nutrient supplements do not correct the problem because they generally contain only the nutrients for which an RDA has been established.
   3. Individuals should plan meals from a wide variety of foods that are not highly refined.

G. RDAs should be used only for specific purposes.
   1. RDAs can be used to calculate the amount of food required for groups such as children or the elderly.
   2. RDAs are useful to estimate food needs and food costs for public assistance programs.
   3. RDAs provide a tool to evaluate national nutritional concerns.
   4. RDAs are used by industry to analyze food needs and to establish an adequate food supply.
      a. A nutrition label must contain the following:
         (1) Serving size;
         (2) Servings per container;
         (3) Calories per serving;
         (4) Grams of protein, carbohydrate and fat per serving; and
         (5) Percentages of the U. S. RDA (U. S. Recommended Daily Allowance) for protein, vitamin A, vitamin C, thiamin, riboflavin, niacin, calcium and iron.

    b. The U. S. RDA is used as a standard for nutrition labeling.
    c. The U. S. RDA for a nutrient is the highest adult RDA value, omitting pregnancy and lactation, for the nutrient.
    d. Nutrition labeling is required only when nutrients are added to the product or when a nutrition claim is made.
    e. The usefulness of nutrition labeling has received much debate.
  5. RDAs were intended for use by groups of people; they are not requirements for individuals. Since it is the only tool of its kind, it is often used to evaluate the adequacy of an individual's diet.

H. A problem with using the RDA table is that RDAs list only nutrients, not the foods that contain them.

III. Tables of Food Composition provide the nutrient contributions of various foods.

A. The U. S. Department of Agriculture Handbook 456 includes calories, protein, fat (saturated vs. unsaturated), carbohydrate, calcium, iron, vitamin A, thiamin, riboflavin, niacin, and ascorbic acid content of selected foods.

B. Food Values of Portions Commonly Used includes the information given in Handbook 456 plus the essential amino acid, sodium, potassium, magnesium, and phosphorus content of foods.

C. Using the RDAs and tables of food composition to plan an adequate diet requires a great deal of mathematics and motivation.

IV. The Basic Four is often referred to as the "Essence of an Adequate Diet."

A. This food guide groups common categories of foods according to their nutrient contributions to the diet.
  1. The MEAT GROUP includes meats, eggs, legumes, and nuts. Two servings per day are recommended.
    a. Significant nutrient contributions from this group include protein, iron, and B-complex vitamins.
    b. Two servings provide about 50% of the protein and iron requirements of adult males, 50% of the protein needs for females and 25-30% of the iron needs of females.
  2. The MILK GROUP includes all dairy products except butter and margarine.
    a. Significant nutrient contributions from this group include calcium, protein, riboflavin, and vitamin D.
    b. Two servings per day are recommended for adults; three to four servings are recommended for children and teens.
  3. The FRUITS AND VEGETABLES GROUP combines foods from two categories.
    a. Four servings or more should be included from this group every day.
    b. One serving per day should be a rich source of vitamin C, such as a citrus fruit or juice.
    c. One serving per day should be a dark green or yellow vegetable or fruit.
    d. This group provides a good source of vitamin C and A if a serving of citrus fruit and dark green or yellow vegetable is included.

4. The BREAD AND CEREAL GROUP adds both nutrients and variety to the diet.
    a. Significant nutrient contributions from this group include protein, calcium, iron, and the B-vitamins, especially niacin, thiamin, and riboflavin.
    b. Whole grains provide a source of nutrients (Vitamin B-6, E, trace minerals, and fiber) which are lost when grain products are refined and processed.
    c. Four or more servings from this group should be included each day.

B. Nutrients emphasized in the Basic Four are proteins, calcium, iron, vitamin A, vitamin C, thiamin, riboflavin, and niacin. It is assumed that if enough of these are consumed there will be enough of the other nutrients but this is not certain.

C. A major criticism of the Basic Four is that it is out-of-step with more recent knowledge about nutrient needs, sources, and practices.
    1. Some food groups are so broad that it is possible to select foods that do not provide all the nutrients relied upon from a group.
    2. Overlapping among groups is also a problem.
    3. Many common foods are difficult to categorize, such as casseroles.
    4. Many food and beverage items are ignored altogether; examples include sweet desserts, soda pop, and fast foods.
    5. The Basic Four is not useful as a guide for alternative food patterns.

D. An alternative to the Basic Four is the categorizing of foods into animal and plant origin; then each category is subdivided into foods with similar nutrients. The chart shown below is an example of food categorizing.

Animal Origin Foods	Major Nutrients
Milk/Milk Products	Calcium, high-quality protein, riboflavin, vitamin A, vitamin D (fortified)
Eggs	High-quality protein, B-vitamins, iron
Flesh - meat, poultry, fish	High-quality protein, iron, B-vitamins (B-6, niacin)
Fats - lard and butter	Vitamin A

Plant Origin Foods	Major Nutrients
Legumes	Low-quality protein, carbohydrate, thiamin, vitamin B-6, iron
Cereals/Cereal Products	Low-quality protein, carbohydrate, vitamin B-6, vitamin E, if whole grain
Fruits and Vegetables	Vitamin A, vitamin C, folacin, carbohydrate, iron, calcium
Oils	Vitamin E, essential fatty acids

V. Nutrient losses occur during refining.

- A. Concern exists about the issue that if we consume enough of the key nutrients, other nutrients will be supplied in the same foods.
- B. Enrichment is the replacement of thiamin, riboflavin, niacin and iron; these nutrients are lost in the milling of cereal products, particularly wheat.
- C. Fortification is the addition of nutrients to foods that do not originally contain them, or contain them in small amounts only.
  - 1. Common examples include:
    - a. Vitamin D is added to milk.
    - b. Iodine is added to salt.
    - c. Fluoride is added to water.
    - d. Vitamin A is added to margarine, non-fat dry milk and to most skim milk products.
    - e. Vitamin C is added to most fruit drinks and some fruit juices.
  - 2. Rigid guidelines exist for fortification practices.
    - a. There must be a clear need for the nutrient.
    - b. The foods to be fortified must be consumed by a significant number of people.
    - c. The nutrients to be added must be stable in the foods to which they are added.
    - d. The additions must not create imbalances; they must be in a form that can be absorbed and utilized by the body.
    - e. There must be no danger of toxicity.
    - f. The cost to the consumer must not be excessive.
  - 3. Concern exists as to what constitutes a "need" for fortification.
    - a. The "need" is evident when a nutrient is not readily available in a diet.
    - b. The "need" is less clear when failure to choose correct food is the problem. Fortification will not prevent poor eating habits or improper food selection.
  - 4. There has been an increase in the production of formulated products that are super-fortified and contain 100% of U.S. RDA per serving.
    - a. Breakfast products are good examples.
    - b. Such products are generally high in calories, sugar, and fat and are low in fiber, protein, and some minerals.
  - 5. Opposition to fortification does exist.
    - a. Some would reserve fortification for adding only the nutrients that are not readily available in the diet, such as vitamin D and iron.
    - b. Many of the newer fortified products increase the use of high calorie, sugar dense, low fiber foods.
  - 6.
    - a. Consumers are resistant to nutrition education and changing eating behavior. Therefore, fortification may help to increase nutrient consumption if fortified foods are consumed.
    - b. To be beneficial, nutrients must be added to foods that people are already eating.
    - c. Much is known about which nutrients are needed and how to fortify successfully.

Study Guide Assignment

After reading the text assignments and viewing the lesson, refer to Nutrition: Concepts and Controversies Study Guide and answer questions on the following pages. If there is any difficulty answering the questions refer to the appropriate chapter of the text. Upon completion of the study guide questions, check the answers with the correct answers from the study guide.

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3	How Well Do We Eat?	45
3	The 10 State National Nutrition Survey	45
3	The HANES	45
3	Nutrition Programs	46
3	Optimal Nutrition	46

Self-Test

After completing all assignments and activities related to this lesson, take the self-test on pages 35-36 and pages 48-49 of the Nutrition: Concepts and Controversies Study Guide. Check the answers with the correct answers from the study guide. Review answers that were missed.

NUTRITION IN PREGNANCY

Foreword

At no time is the effect of nutrition on future health more dramatically demonstrated than during the early development of an infant in its mother's uterus. Nutrient needs during periods of intense growth are greater than at any other time, and they are greater for certain nutrients than others. It is well known and accepted that the mother who consumes a good diet prior to and during pregnancy has a better chance of delivering a healthy child than the mother whose diet is inadequate. In this unit, the importance of a good diet during pregnancy is stressed. The nutritional needs of the fetus throughout the three physiological stages of its development will be examined, as well as the nutrient needs of the mother.

Objectives

Upon completion of this lesson which includes text assignments, video viewing, and study guide activities, the participant should be able to:

1. Recognize that nutrition is one of the many factors which influence the outcome of pregnancy.
2. Specify the range of recommended weight gain during pregnancy for women of normal pre-pregnancy weight.
3. Identify the three developmental stages of pregnancy.
4. Assess the consequences of malnutrition on each developmental stage.
5. Indicate the nutrients which have an increased importance during pregnancy.
6. Discuss problems which may arise during pregnancy from inadequate intake of nutrients.
7. Identify groups of individuals who may be particularly susceptible to the stresses of pregnancy.

Text Assignments

1. Before viewing the video lesson, complete the following reading assignments from Nutrition: Concepts and Controversies by Hamilton, Whitney and Sizer.
2. Review the Recommended Dietary Allowances (RDA), especially for iron and calcium, for pregnancy and lactation. The RDA table is located in the front of the text.

Chapter	Topic	Page
13	Mother and Newborn Infant	378

Lesson Outline

I. The health status of a child at birth is influenced by numerous factors.
  A. The factors which influence the child's health status are those which are present at conception and those that occur during pregnancy.
    1. Factors present at conception include:
      a. Genetics,
      b. Health of the mother including size, height, weight, and
      c. Number of previous pregnancies and intervals between pregnancies.
    2. Factors that occur during pregnancy include:
      a. Illness,
      b. Drugs, and
      c. Dietary deficiency of the mother, especially deficits in total calories or protein, as these may cause low birth weight and/or premature birth.

  B. Infants born to mothers who were well nourished before and during pregnancy are likely to be healthier than infants born to poorly nourished mothers.

  C. Pregnancy is a normal physiological occurrance, but it is a period of physiological stress. The mother must supply all nutrients needed by the developing fetus.
    1. If the mother's diet is deficient in nutrients, both the mother and fetus are affected.
      a. Some nutrients may be drawn from the mother's reserves and damage her health.
      b. Other nutrients will be deficient for both mother and fetus.
    2. Nutrients are required for:
      a. Fetal nutrition,
      b. Placental development (placenta is the organ that connects the mother to the fetus and through which nutrients are provided to the fetus and fetal wastes returned to the mother's blood), and
      c. Maternal tissues, such as breasts, uterus, and expanded blood volume.

II. Nutritional needs of the fetus vary depending upon the stage of fetal development.

  A. The implantation period is the first two weeks after conception.
    1. This is a period of rapid cell division.
    2. Nutrients are obtained from the uterine environment.
    3. Prior nutritional status of the mother is crucial.
    4. Pregnancy will be terminated if nutritional deprivation occurs; 40% of fertilized eggs do not survive this stage.

  B. The embryonic period is the second through eighth week of pregnancy.
    1. Organogenesis, which is the development of fetal organs, takes place.
    2. Nutrients are obtained from the mother's blood supply via the placenta.
    3. The quality of the mother's diet is very important during this period.

4. Malformation may occur if anything interferes with organogenesis; examples include measles or drugs. It is uncertain if malnutrition causes malformation of the infant, but much concern surrounds this issue.

C. The fetal period is a period of rapid tissue growth.
   1. Nutrients are obtained from maternal blood via the placenta.
   2. Diets of poor nutritional quality and/or low in quantity of food result in premature or low birth weight infants who are more susceptible to childhood illnesses.

III. Some nutrients are of particular concern during pregnancy.

A. Protein is needed for increased tissue systhesis.
   1. The average American woman does not need to increase her protein intake during pregnancy because American diets are usually high in protein.
   2. The RDA for pregnant women is an additional 30 grams over the non-pregnancy RDA, or 76 grams per day. This amount allows for adequate protein deposition during pregnancy (925 g total).
   3. Higher intakes of protein (above the RDA) do not appear to be beneficial to either the mother or child.
   4. Two-thirds of the protein recommended should be of high biological value.

B. Iron is needed in increased amounts during pregnancy.
   1. Many women enter pregnancy with low iron reserves.
   2. The daily iron requirement increases to meet the needs of both the mother and the fetus.
      a. There is increase in maternal blood flow.
      b. Additional iron is needed for the development of the fetal blood system.
      c. The increase in iron is also necessary for the development of fetal iron stores to last from 3-6 months after birth.
   3. Part of the increased iron needs during pregnancy are met by increased absorption of iron from the gastrointestinal tract and by the cessation of menstruation.
   4. An iron supplement of 30-60 mg. is recommended due to the difficulty of including the additional amounts needed from food alone.

C. Calcium requirement is increased during pregnancy to meet fetal needs. The fetus must accumulate 25 to 30 gm. of calcium during pregnancy.
   1. Calcium requirement increases from 800 to 1200 mg. per day during pregnancy.
   2. The absorption of calcium from the mother's intestinal tract is increased.
   3. If the mother's diet is not sufficient in calcium, the fetus draws calcium from her bones.

D. Sodium plays an important role during pregnancy.

1. Sodium's role in pregnancy has often been misunderstood. It was once believed that too much sodium in the diet caused toxemia of pregnancy.
2. More recent studies indicate that low sodium diets may be linked to the development of toxemia of pregnancy.
3. Sodium is an important constituent of body fluids.
   a. The volume of body fluids increases during pregnancy.
   b. Restricted sodium intake during pregnancy may create an imbalance in the distribution of body fluids.
4. A total of 11 to 20 grams of sodium over that normally needed is required during the entire course of a pregnancy.

IV. Physiological changes in the mother influence her nutritional needs during pregnancy.

A. An increase in blood volume occurs due to an increased need for nutrients to be supplied to the uterus, placenta and fetus, as well as increased need to transport wastes from these.

1. There is a greater increase in the plasma portion of blood than in the red blood cells.
2. This causes a lower concentration of red blood cells which often is misdiagnosed as iron deficiency anemia.

B. Relaxation of the smooth muscles in the gastrointestinal tract accompanies pregnancy.

1. This relaxation slows the movement of food through the intestines.
2. Higher percentage of nutrients are absorbed; this is probably because food moves more slowly through the gastrointestinal tract.
3. Folacin is less efficiently absorbed and often low or marginal in the diets of pregnant women.

C. Weight gain during pregnancy should be related to the weight distribution of different tissues.

1. The amount of weight gained is an important determinant of the outcome of pregnancy.
   a. Too little weight gain produces a low birth weight baby and low fat storage in the mother, which may affect her ability to adequately breast feed.
   b. Too much weight gain may cause greater difficulty during delivery and later problems of obesity for the mother.
2. Components of weight gain are as follows:

a.	Amniotic fluid	2.0 lbs.
b.	Placenta	1.5 lbs.
c.	Fetus	7.0 lbs
d.	Uterus	2.0 lbs.
e.	Breasts	1.0 lbs.
f.	Blood (maternal)	3.0 lbs.
g.	Tissue fluids (maternal)	3.0 lbs.
h.	Fat storage (maternal)	9.0 lbs.
	Total	28.5 lbs.

3. The recommended weight gain during pregnancy is approximately 30 pounds.
4. To avoid excessive weight gain, caloric increases should be limited to 300 Calories per day during the second half of pregnancy.

Study Guide Assignment

After reading the text assignment and viewing the lesson, refer to Nutrition: Concepts and Controversies Study Guide and answer questions on the following pages. If there is any difficulty answering the questions, refer to the appropriate chapter of the text. Upon completion of the study guide questions, check the answers with the correct answers from the study guide.

Chapter	Title	Page
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Self-Test

After completing the assignment and activities related to this lesson, take the self-test on pages 225-228 of Nutrition: Concepts and Controversies Study Guide. Check the answers against the answer key. Review answers that were missed.

*Note: Many of the facts presented in Chapter 13, "Mother and Newborn Infant," will relate and overlap into the unit on "Nutrition and Infancy."

NUTRITION IN INFANCY

Foreword

The first year of life is a period of rapid growth, and there is a significant increase in nutrient needs for the infant. Over the years, this issue has created a considerable interest in the subject of infant feeding. The type of foods a child receives during the first years of life have a significant influence on the development of eating patterns and subsequently the health of that individual later in life. Questions that are frequently asked about infant feeding are as follows: Is milk sufficient to sustain the growth of the infant, and for how long? Should supplements be given to infants? When should solid foods be introduced? Answers are provided in this unit for these frequently asked questions.

Objectives

Upon completion of this lesson which includes text assignments, video viewing, and study guide activities, the participant should be able to:

1. Indicate the nutrients that should be increased to meet nutritional needs during lactation.
2. Evaluate the recommended daily caloric increase for lactating women.
3. Relate increased nutrient requirements to specific recommendations for increasing certain foods during lactation.
4. List four benefits to both the mother and infant that may be derived from lactation.
5. Name the clear liquid, derived from human milk, which contributes immunity to the infant.
6. Discuss human and cow's milk with respect to their carbohydrate, protein, and fat content.
7. Compare the infant's ability to digest the protein in both cow's and human milk.
8. Identify two fat-soluble vitamins which should be provided to the infant in supplemental form because they are not supplied in adequate amounts in breast milk.
9. Specify the appropriate age for the introduction of solid foods and high protein foods into the infant's diet.
10. List three nutrients which, according to surveys, have been shown to be inadequate in the diets of children under age three.
11. Describe four characteristics which influence food acceptance by children.

12. Identify three adult health conditions which may be associated with patterns of eating established during childhood.

Text Assignments

1. Before viewing the video lesson, complete the following reading assignments from Nutrition: Concepts and Controversies by Hamilton, Whitney and Sizer.

Chapter	Topic	Page
13	Mother and Newborn Infant	390
13	Behavior, Allergies and Additives	404
14	Infant, Child and Teenager	410
14	Behavior, Nutrient Deficiencies and Sugar	438

2. Become familiar with the glossary at the end of Chapters 13 and 14.

Lesson Outline

I. Optimal nutrition during infancy permits development to realize its full potential.

   A. Human milk is the ideal food for the infant.

   B. Safe bottle feeding has been practiced widely in this country only since the turn of the century.

   C. There is currently a resurgence of interest in breast feeding particularly among young, well-educated women.

   D. Infant formulas based on cow's milk which has been modified to resemble human milk are now available.

II. Human (breast) milk provides an excellent nutrient source for the infant.

   A. Colostrum is the first secretion of the breast after delivery (birth through six days).
      1. This liquid is very nutritious.
      2. It also provides immunity to the infant against many microorganisms.

   B. Transitional milk is secreted from 6 to 10 days after delivery.

   C. Mature milk is secreted about 10 days after delivery.

III. Mature breast milk and cow's milk differ in their nutrient composition.

   A. Both milks contain approximately 600 Calories per 850 ml. which is about the amount the infant will drink per day.

   B. The proportion of calories derived from fat in the two milks is the same, but the proportions derived from protein and carbohydrate differ.

   C. The composition of cow's milk reflects needs of the more rapidly growing calf.

D. The protein in milk is found in curds and whey.
   1. Human milk contains predominantly the whey proteins, lactalbumin and lactoglobulin. These are easier for infants to digest.
   2. Cow's milk contains predominantly the curd protein, casein. It is more difficult for infants to digest casein.

E. Human milk contains more carbohydrate (lactose) than cow's milk, and this enhances absorption of calcium and magnesium.

F. The fat in human milk contains a higher proportion of unsaturated fatty acids and more of the essential fatty acid, linoleic acid.

G. The vitamin and mineral content of the two milks differ.
   1. Calcium and phosphorus are higher in cow's milk. This reflects the more rapid growth of a calf. There is about 4 times more calcium in cow's milk than in human milk.
   2. Iron is low in both milks, although human milk has a slightly higher level. Also, the iron in human milk is better utilized.
   3. Vitamin C is low in both milks, and cow's milk contains only one-third of the amount found in human milk.

H. Human milk contains the lactobacillus bifidus factor.
   1. This factor provides a good medium in the gastrointestinal tract for growth of the micro organism lactobacillus bifidus.
   2. Lactobacillus bifidus produces lactic acid which decreases the growth of harmful organisms in the gastrointestinal tract.

IV. Milk is the mainstay of the diet for the infant.

A. Human milk is adequate (assuming the mother is well nourished) in most nutrients.
   1. An exception is vitamin D. A supplement of this vitamin should be received by three days after birth. Care must be taken to assure that the dose is not excessive.
   2. Also, vitamin K is an exception. This is due in part because the gastrointestinal tract of the newborn is sterile; the infant should be given a supplement immediately after birth.

B. Even though the protein content of human milk is lower than that of cow's milk, human milk is adequate for the first six months of the infant's life.

C. A rule of thumb is that pure cow's milk should not be given to the child until he is capable of drinking from a cup unassisted.

D. Modified, commercially manufactured formulas prepared from non-fat cow's milk are sometimes used for infant feeding.
   1. Cow's milk is modified to reduce the protein and mineral content to a level which is suitable for the infant.
   2. Manufacturers of this modified product combine demineralized whey with non-fat milk to produce a product similar to that of human milk.
   3. Heat processing of this product reduces several vitamins, particularly vitamin C and vitamins of the B-Complex. For this reason, vitamins and minerals are added to the milk after processing.

4. Additional supplementation may be necessary depending upon the formula selected.
    a. Vitamin C may require supplementing; the infant should receive a supplement by the tenth day of life.
    b. Iron supplements, from birth, may be beneficial in preventing iron deficiency anemia later in infancy.
        (1) Infants born to iron deficient mothers have low iron stores at birth; they particularly need a supplement if bottle fed.
        (2) Iron supplements are not needed for breast-fed infants because of the higher levels of iron in breast milk; this iron is well utilized by the infant.

D. For infants who have conditions that contraindicate the use of cow's milk, soy-based milks are used. Approximately seven percent of bottle fed infants develop allergies to cow's milk.
1. Allergies rarely develop in breast fed infants.
2. Cow's milk cannot provide immunity or the lactobacillus bifidus factor.

V. Breast feeding offers special advantages for both the mother and the infant.

A. Benefits for the mother are both physiological and psychological.
1. Breast feeding may aid the mother in the loss of excess body fat that accumulates during pregnancy to be used as an energy reserve.
2. The uterus of the lactating woman returns to normal size more quickly.
    a. Oxytocin is secreted in response to sucking.
    b. Oxytocin stimulates milk release and contraction of the uterus.
3. There is an apparent delay of ovulation during lactation. This is most beneficial in populations that do not have access to birth control methods.
4. Lactation may be psychologically beneficial to the mother. She may feel more confident in her role and closer to the infant.

B. There are reasons for which breast feeding may not be indicated.
1. The mother may have a psychological aversion to breast feeding.
2. The mother may be taking a drug that may be passed through milk to the infant.
3. The mother may have a disease that may be transmitted through milk.

C. The nutrient needs of the lactating woman are higher because of rapid fetal development.
1. The recommended intake for most nutrients is increased above pregnancy levels. Exceptions to this are protein and folacin.
2. The mother needs approximately 750 extra Calories daily in order to produce 850 ml. of milk. The diet should provide daily 500 Calories of these extra calories; the remainder can be contributed by fat accumulated during pregnancy. If 9 pounds of fat are stored during pregnancy, this contributes 250 Calories per day for three months.
3. The lactating woman requires additional protein. Approximately 20 grams above the non-pregnancy RDA, or 66 grams, is needed daily.
4. If calories and protein are inadequate in the mother's diet, the volume of milk will decrease and this may retard the infant's growth.

5. About 1200 mg. of calcium are required daily to provide for the infant's needs without depleting maternal calcium reserves.
6. If the water-soluble vitamins are not adequate in the mother's diet, her milk will also be deficient in these even though the quantity of milk is adequate. An example of such a deficiency is thiamin.
    a. Thiamin deficiency is more severe if the mother's diet is high in carbohydrate because of the role thiamin plays in utilizing carbohydrates for energy.
    b. Thiamin deficiency is rare in the U. S. but occurs in developing countries. As a result of the thiamin deficiency, infants develop beriberi.
7. The lactating mother must select extra servings of certain foods to meet the additional nutrient demands.
    a. Two extra servings of milk should be consumed daily.
    b. One extra serving of high quality protein (other than milk) is recommended daily.
    c. One extra serving of citrus fruit per day is suggested.
8. Four or five small meals are recommended for the lactating mother in order for her to consume all the food needed.

VI. Solid foods should be introduced slowly.

A. The infant does not become physically or physiologically ready to receive solid foods until three to four months of age. Then, saliva for lubricating food is produced, and the swallowing reflex has developed.

B. A source of iron is needed by three to four months; iron enriched cereals may be introduced into the diet at this time.

C. It is advisable to introduce solids one at a time in order to identify any allergic response they might cause.
    1. Rice cereal should be introduced first, followed by barley, oatmeal, and a mixture of wheat, oats and corn.
    2. A variety of other foods follow the cereals.

D. At six months of age, the infant is capable of digesting more foods, and absorbing the nutrients contained in them.

E. At eight months of age, the infant begins to enjoy textural variations in foods.

F. Many factors influence the introduction of solid foods.
    1. The ability to tolerate high protein foods occurs at about six months of age.
    2. The eruption of teeth to allow chewing occurs at about seven months of age.
    3. The child's development of desire for more texture in foods occurs about eight months of age.

G. Solids, if introduced too soon, may cause serious problems.
  1. The phychological impact of force feeding may create aversions to food.
  2. Excess protein and sodium tax the immature kidney.
    a. Dehydration occurs if too much urine is excreted.
    b. Water retention occurs if too much sodium is retained.
    c. There exists a possiblity of developing hypertension later in life if these nutrients are introduced too early.

H. Solids should not be introduced until after 3 months of age.

VII. The young child presents a feeding challenge.

A. Children need a wide variety of foods in their diets. Milk is important in a child's diet but should not be consumed at the exclusion of other foods.

B. Nutrient needs during early childhood are based on optimal growth and development.
  1. The rate of growth levels off after the first four months of life.
  2. More caloric intake is used for energy during infancy and less for growth.
  3. More protein is used for maintenance during infancy and less for synthesis of new tissues.

C. National nutrition surveys have shown that some nutrients may be low in children's diets.
  1. The protein intake of children under age three is usually adequate.
  2. The iron, vitamin C, and vitamin A intakes of young children may be inadequate.
    a. According to one survey, over 40% of one- to five-year-olds had low iron intakes. This may be related to the over-consumption of milk, as milk is low in iron.
    b. In the same survey, about one-third of the children had low vitamin C intakes.
    c. In developing countries, children may have inadequate vitamin A intakes also.

D. Dietary excesses may pose problems for young children.
  1. Excessive calories may lead to childhood obesity.
    a. Overfeeding the infant may stimulate excess formation of adipose cells.
    b. Most concern for over-consumption is for the bottle fed infant.
      (1) Mothers tend to encourage the infant to drink all that is in the bottle.
      (2) This practice may teach the child to ignore his own internal feelings of fullness.
  2. Although calories may be in excess in the diet, intake of other nutrients may be inadequate. Iron is of particular concern.
  3. There may be a relationship between dietary intakes of fat and cholesterol during childhood and the development of atherosclerosis later in life. It is wise to discourage the development of an acquired preference for cholesterol rich and fatty foods.

F. Meeting the child's nutritional needs may be difficult if the child does not readily accept the introduction of a variety of foods. A child's acceptance of new foods will be influenced by a variety of factors.
  1. Children prefer mild temperatures in foods.
  2. Children prefer mild flavors rather than strong ones.
  3. Children prefer moist, soft foods to dry, hard foods.
  4. The ease with which the food may be handled is also a factor; children prefer foods they can handle easily with their hands.
  5. Children prefer small portions of food that do not seem overwhelming.

Study Guide Assignment

After reading the text assignments and viewing the lesson refer to Nutrition: Concepts and Controversies Study Guide and answer questions on the following pages. If there is any difficulty answering the questions, refer to the appropriate chapter of the text. Upon completion of the study guide questions, check the answers with the correct answers from the study guide.

Chapter	Title	Page
13	Advantages of Breast Feeding	222
13	When Not to Breast Feed	223
13	Formula Feeding	223
13	When Breast Feeding is Preferred	223
13	The Choice of Formula	223
13	Behavior, Allergies and Additives	223
14	First Foods for the Infant	238
14	Supplements in the First Year	238
14	Nutrient Needs	238
14	First Foods	238
14	Looking Ahead	239
14	Problem Situations at Mealtime	239
14	Secular Trends in Nutrition	239
14	Early and Middle Childhood	240
14	Nutrient Needs and Feeding	240
14	Nutrition at School	240
14	Television and Vending Machines	240
14	Looking Ahead	241
14	Food Feature: Mealtimes with Children	241
14	Behavior, Nutrient Deficiencies and Sugar	242

Self-Test

After completing all assignments and activities related to this lesson, complete the self-test for Chapter 13 found on pages 225-229, and the self-test for Chapter 14 on pages 244-247 of Nutrition: Concepts and Controversies Study Guide. Check the answers in the answers section of the study guide, and review answers that were missed.

NUTRITION IN AGING

Foreword

According to recent studies, the average life expectancy has increased from 47 to 70 years. This has come about because more infants are surviving to adulthood; therefore, there are fewer infant deaths to bring the average down. With the increased life span, a question frequently asked is "what is the quality of life during these additional years?" A large percentage of individuals over 65 years of age are extremely vulnerable to nutritional deficiencies. Many experience physical ailments associated with degenerative changes which occur with aging. Many suffer social and psychological stresses such as loneliness, the loss of a spouse, or living on a fixed income which is often at the poverty level. This unit will discuss the impact of several physiological and socioeconomic aspects of aging on the nutritional status of the elderly. Particular emphasis will be given to the nutrients at risk and approaches to correcting and preventing nutritional deficiencies.

Objectives

Upon completion of this lesson which includes a text assignment, video viewing, and study guide activities, the participant should be able to:

1. Discuss the relationship between nutrition and health in later years in life.
2. Relate the effects of a declining basal metabolic rate on energy needs of the elderly.
3. Name three theories which have been proposed to explain the physiological changes that occur during the aging process.
4. Relate five physiological changes that frequently occur with aging to changes in food intake among the elderly.
5. Identify three factors which may be related to the development of osteoporosis.
6. Specify the approximate percentage of the elderly in the U. S. who may be osteoporotic.
7. Relate psychosocial characteristics of the lifestyles of many elderly individuals to their dietary intake.
8. Identify groups of foods which are often under-represented in the diets of the elderly.
9. Differentiate between the goals of the Congregate Meal Program and those of the Meals-On-Wheels Program.
10. Specify the criteria for eligibility for the elderly to participate in food assistance programs.

11. Recognize that food habits of the elderly are not inflexible and may be modified by appropriate nutrition information.

Text Assignment

Before viewing the video lesson, complete the following reading assignments from Nutrition: Concepts and Controversies by Hamilton, Whitney, and Sizer.

Chapter	Topic	Page
15	The Later Years	444
15	Controversy 15 - Alcohol and Nutrition	470

Lesson Outline

I. Socioeconomic, psychological and physiological changes are experienced by the elderly. Nutrition is often related to these changes.

II. Although the lifespan has increased over the years, aging is a process common to all.

A. There is an increasing proportion of elderly in our population due to a longer life span, 70 years for men, 72 years for women.

B. The rate of aging varies among individuals. Some remain vigorous longer than others.

III. The physiological response to aging is one in which catabolic processes exceeded anabolic processes.

A. There is a gradual decrease in protein tissue after the fourth decade of life, but not massive cell loss.

B. There is a gradual reduction in function in various body tissues.
1. Nerve conduction is less efficient.
2. Cardiac output is reduced.
3. Kidney function declines.
4. The breathing capacity of the lungs is reduced.

C. The basal metabolic rate decreases after age 30. At age 75, BMR is only 84% of that at age 30.

D. Athletic ability declines after the mid-twenties.

E. There is no significant drop in I. Q. before age 70. It is likely that learning capacity remains throughout life.

IV. Several theories have been suggested to explain the physiological response to aging.

A. Aging is biologically predetermined. The aging process is coded into the DNA, and environmental factors, including nutrition, may interact with genetics to either hasten or retard the rate at which the aging process occurs.

B. The "something is bound to go wrong" theory suggests that age-related changes occur randomly in various tissues because no mechanism works perfectly and something is bound to go wrong eventually. Protein synthesis is particularly vulnerable in these changes.

C. The Free Radical Theory surmises that small unstable fragments of molecules, called free radicals, react with nearby molecules resulting in degenerative changes.
   1. Free radicals may result from normal cellular reactions or they may be produced by external events; for example, ozone may cause the production of free radicals.
   2. Vitamin E, by acting as an antioxidant, may retard free radical formation, thus slowing the rate of damage caused by these molecules.

D. The capacity of the body's immune system may diminish. This may result in the mistaken destruction of normal body cells by antibodies.

V. It is believed that there is a relationship between nutrition and health in later years. Epidemiological studies support this relationship.

A. Poor nutrition exacerbates the development of chronic degenerative diseases.

B. Excessive caloric intake enhances the development of diabetes and/or atherosclerosis.

C. The number of taste buds decreases with age, thereby reducing the pleasure of eating.

D. Many elderly individuals experience digestive discomfort such as heartburn and gastric distention.
   1. Certain foods may be avoided as an attempt to reduce this discomfort.
   2. Decreased secretion of digestive (gastric and intestinal) enzymes and bile may also lead to inadequate digestion and absorption of foods.

E. Aging is accompanied by some loss of neuromuscular coordination. This loss may lead to difficulty in handling utensils, thereby limiting food choices to those which are easily cut and handled.

VI. Nutritional needs during aging reflect a decline in activity.

A. Energy needs are reduced due to decreased physical activity and a decline in the function of certain organs in the body; this causes a reduction in the basal metabolic rate (BMR).
   1. The daily caloric allowance of a man over 51 years of age is reduced by 300 Calories compared with a younger man.
   2. The daily caloric allowance of a woman over 51 years is decreased by 200 Calories compared with a younger woman.

B. Iron needs of the post-menopausal woman are decreased.

C. Other nutrient needs are not reduced in later life; one example is calcium.
  1. In adults, a proper balance of calcium deposition and withdrawal in bones is necessary.
    a. If withdrawal (resorption) is excessive, osteoporosis, or loss of both minerals and bone matrix may occur.
    b. Bones become porous and fragile.
  2. Approximately 20% of the over age 65 population may be afflicted by osteoporosis; it is four times as prevalent among women as men.
    a. Pain in the lower back is characteristic of the disease.
    b. Bones fracture easily.
    c. There is a decrease in height due to changes in bone in the vertebral area.
  3. Multiple factors are implicated in the cause of osteoporosis.
    a. A dietary deficiency of calcium, particularly when accompanied by a deficiency of vitamins C and D, is suggested as a cause.
    b. Also implicated is a diet that is high in phosphorus and low in calcium (too much phosphorus interferes with proper utilization of calcium in the body) for an extended period of time.
    c. The hormonal changes which accompany aging create an inbalance between anabolic hormones and catabolic hormones.
    d. Earlier drains on skeletal reserves of calcium during pregnancy and lactation, particularly if intake of calcium was low, influence the development of the disease.
  4. It is believed that the best protection against osteoporosis is an adequate calcium intake throughout periods of growth and adulthood.
  5. Many elderly persons do not realize the importance of adequate calcium intake.
    a. Milk is often considered to be for children only.
    b. Low levels of lactase (lactose-digesting enzyme) may cause gastric discomfort when milk is consumed.

VII. Nutrition is a factor in the psychology and sociology of aging.

A. The lifestyle of the aged population of the U. S. may influence the food intake and nutritional status of this group.
  1. Of the 25 million elderly in the U. S. (65 years+), 75% live in communities with friends or relatives, 20% live alone, and 5% are institutionlized.
  2. Their economic status may be inadequate. In 1974, one-half of the elderly population in the U. S. had incomes below $1,500 per year, and half of these were below $1,000 per year.
  3. Social isolation is a frequent occurrence among the elderly; this may reduce interest in looking after themselves.
  4. Old-age discrimination may produce feelings of helplessness and an inability to care for themselves.
  5. Fear for personal safety may limit social interaction. It may also limit food shopping and subsequently food intake.
  6. Lack of transportation may limit shopping choices; this may lead to an expensive, monotonous diet.

B. A relatively high incidence of undernutrition exists among the elderly in the U. S. No other age group is quite as vulnerable to nutritional deficiencies.
   1. Calories may be inadequate.
   2. Protein may be inadequate particularly if calories are inadequate and protein is being used for energy.
   3. Iron may be inadequate especially if calories are low.

C. Diets of the elderly are often poor.
   1. Their intake of fresh fruits and vegetables may be minimal resulting in low intakes of vitamins A and C.
   2. Meat and milk intake may also be minimal; these are expensive items to purchase.

D. The proportion of the elderly affected by these problems is questionable.
   1. The elderly living alone are not accessible to study. Therefore, the institutionalized elderly are most often studied.
   2. A greater percentage of free-living elderly do stay healthy and are more vigorous much later in life, particularly when involved with family and community. They also have more adequate diets.
   3. The elderly who are most likely to suffer severe nutritional related problems are those who live alone and those who are poor.

VIII. Feeding programs are one way to improve the nutritional status of the elderly.
   A. The Congregate Meals Program was designed to stimulate social involvement as well as provide nutritious meals. Recreational and social events are generally provided.

   B. The Meals-On-Wheels Program was designed to improve nutrition among the housebound elderly.

   C. These two feeding programs are aimed at meeting the nutritional needs of the elderly, regardless of income level.

IX. There are other approaches to improving nutrition in the elderly.

   A. Past beliefs that eating habits of the elderly are inflexible are being replaced by the recognition that the elderly do respond to nutrition information when this information is both motivating and appropriate.

   B. Evidence of their willingness to change dietary habits and concern for health is demonstrated by the fact that the greatest market for health foods is among the elderly.

   C. The use of dietary supplements is widespread among the elderly because of their concern about becoming ill.
      1. Supplements rarely supply all the necessary nutrients particularly energy, protein and calcium.
      2. Guidance is needed in selecting appropriate supplements or in counseling against the use of supplements when they are not indicated.

   D. The economic, emotional, and physiological factors which influence the nutritional status of the elderly are difficult problems to overcome, particularly among isolated and poor elderly.

Study Guide Assignment

After reading the text assignments and viewing the lesson, refer to the Nutrition: Concept and Controversies Study Guide and answer questions on the following pages. If there is difficulty answering the questions, refer to the appropriate chapter of the text. Upon completion of the questions, check the answers with the correct answers in the study guide.

Chapter	Title	Page
15	Introductory Questions	256
15	The Aging Process	256
15	Aging of Cells	256
15	Aging of Systems	256
15	Can Aging Be Prevented	257
15	Nutrition, Aging and Disease	257
15	Nutrition Implications of Aging	257
15	Nutrients	257
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15	Food Feature: Practical Pointers	258
15	Mealtimes Alone	258
15	Assistance Programs	259
15	Nursing Homes	259
15	Preparing for the Later Years	259
15	Alcohol and Nutrition	259

Self-Test

After completing all assignments and activities related to this lesson take the self-test on pages 262-265 of Nutrition: Concepts and Controversies Study Guide. Check the answers in the self-test answers section, and review answers that were missed.

CARBOHYDRATES

Foreword

This lesson examines the role of carbohydrates in supplying the energy needs of the body. It also investigates a controversial issue surrounding carbohydrate consumpton. Because carbohydrates are the class of nutrients most related to calories, it is the nutrient group that is most avoided by weight conscious individuals. This study of carbohydrates begins with an overview of the low carbohydrate diet. Included in this section is a description of the body's response to a low-carbohydrate diet and an analysis of this reponse as it relates to basic energy functions of carbohydrates in the body.

Objectives

Upon completion of the lesson which includes text assignment, video viewing, and study guide activities, the participant should be able to:

1. Name the primary function of carbohydrates.
2. Associate low-carbohydrate diets with an increase in fat utilization and accumulation of ketones.
3. Recognize that excretion of accumulated ketones causes increased sodium and water loss.
4. Recognize that weight loss which accompanies a low-carbohydrate diet is due to urinary loss of body fluid.
5. Discuss three harmful effects that may result from a low-carbohydrate diet.
6. List the origins and functions of four commonly known members of the carbohydrate family.
7. Differentiate among monosaccharides, disaccharides, and polysaccharides with regard to the number of simple sugar units included in the structure of each.
8. Name two examples of monosaccharides, disaccharides, and polysaccharides.
9. Identify the most abundant carbohydrate in the body.
10. Indicate the raw materials used by plants for the synthesis of glucose.
11. Recognize that photosynthesis demonstrates the most fundamental interdependence between plants and animals.

12. Distinguish glucose as the major fuel source for body tissues especially in the central nervous system.

13. Recognize that most ingested carbohydrates are converted to glucose in the body.

14. List the parts of plants that are likely to be rich in carbohydrates.

15. Identify the animal-source of food that contributes significant amounts of carbohydrate in the diet.

16. Compare foods of plant and animal origin with regard to their carbohydrate content.

17. List two forms in which the body stores glucose that is not needed immediately as an energy source.

18. Recognize that cultural groups differ with regard to the proportion of total calories in the diet provided by carbohydrates.

19. List the functions of cellulose in plants.

Text Assignments

1. Before viewing the video lesson, complete the following reading assignment from Nutrition: Concepts and Controversies by Hamilton, Whitney, and Sizer.

Chapter	Topic	Page
4	The Carbohydrates: Sugar, Starch and Fiber	68
4	Controversy 4: Sugar	87
4	Controversy 11: The Aspartame Issue	352

2. Review the terms located in the glossary of Chapter 4 of Nutrition: Concepts and Controversies, pages 83-85.

Lesson Outline

I. Low-carbohydrate diets are often used for the purpose of weight reduction.

    A. Many questions have been raised about the diets' potential benefit or harm to the individual.

    B. Carbohydrates play a major role in the body.
        1. The primary role is the provision of energy.
        2. Excess carbohydrates are stored as glycogen or fat to be used as an energy reserve.

    C. The body responds to low-carbohydrate diets in many ways.
        1. Glycogen stores decrease.
        2. Fat utilization increases.
        3. Ketones (intermediate fat by-products) accumulate in the blood and urine.
        4. There is an increased loss of water and sodium as the kidneys attempt to rid the body of ketones through increased urinary output.

D. Early weight loss associated with low-carbohydrate diets is due to water loss or diuresis.

E. When carbohydrate is reintroduced into the diet, the harmful reactions are reversed.

F. Much concern exists over the use of low-carbohydrate diets for weight reduction.
   1. The diet potentially interferes with liver functions.
   2. There is an increased reliance on animal foods which increases fat and cholesterol intake.
   3. The diet creates a potential upset of the acid-base balance in the blood. This imbalance is caused by a combination of ketosis and sodium loss.
      a. Ketones are weak acids.
      b. The long-term effects of ketosis are unknown.
   4. The diet increases the chance of low intakes of other nutrients, especially vitamins A, C, and minerals, as well as fiber.

G. Both promises and pitfalls accompany the low-carbohydrate approach to weight reduction.
   1. A promise is the immediate loss of several pounds. Another promise is that the diet is based on sound nutritional knowledge.
   2. The pitfalls are many.
      a. Water weight is the primary loss.
      b. The possibility of impaired liver function exists.
      c. Protein is used as an energy source.
      d. Cholesterol intake is elevated.
      e. Ketosis ensues.
      f. The deficiency of other nutrients is possible.
      g. Nutrient sources are misused.

II. The carbohydrates are a class of nutrient substances.

A. The commonly known carbohydrates include:
   1. Sugars, such as table sugar and honey;
   2. Starches, such as cornstarch and the starch in bread; and
   3. Cellulose, which is found in plants and is indigestible by humans.

B. Carbohydrates are classified as saccharides which means "sweet."
   1. Monosaccharides are commonly referred to as simple sugars. Examples include:
      a. glucose,
      b. galactose,
      c. mannose, and
      d. fructose.
   2. Disaccharides are formed by the combination of two monosaccharide units. Examples include:
      a. sucrose, or table sugar, which is the combination of glucose and fructose;
      b. lactose, or milk sugar, which is the combination of glucose and galactose; and
      c. maltose, or malt sugar, which is the combination of two glucose units.

    3. Polysaccharides are complex carbohydrates. Many monosaccharide units linked together as straight or branched chains form a polysaccharide.
        a. Starch is a polysaccharide that is found in foods of plant origin. Starch is made of many glucose units joined together by alpha-linkages; it can be digested and absorbed by humans.
        b. The polysaccharide, glycogen, is a storage form of carbohydrate that is found in animal liver and muscle tissues.
        c. Cellulose is a polysaccharide which is made by joining many glucose units with a beta-linkage. This beta-linkage cannot be broken by humans; therefore, cellulose is undigested. Cellulose provides fiber to human diets. It is found in fruits, vegetables and grains.

C. Glucose is the most abundant member of the carbohydrate family.
    1. It is synthesized by chlorophyll containing plants from carbon dioxide, water, and the sun's energy through a process known as photosynthesis.
        2. Photosynthesis demonstrates the most fundamental interdependence between animals (including humans) and plants.
            a. Enhaled carbon dioxide is used in photosynthesis.
            b. The oxygen released during photosynthesis is used in animal respiration (oxidation).
            c. Carbohydrate (glucose) formed during photosynthesis is the basic source of energy for humans and animals.
        3. Glucose is the most commonly used fuel source in body tissues, especially in the central nervous system.
        4. Glucose is derived primarily from dietary starches and sugars; it can be synthesized in the body from amino acids.

III. Carbohydrates are abundant in the food supply.

    A. Foods of plant origin are the chief contributors of carbohydrates to the diet.
        1. Rich sources of carbohydrates include roots, seeds, and fruits of plants.
        2. Very poor sources of carbohydrates are flesh foods, eggs, cheese, and fats.

    B. Lactose, the disaccharide in milk, is the only significant animal source of carbohydrate.

IV. Carbohydrates consumed in the diet are converted mainly to glucose. This glucose is used for energy or converted to glycogen and/or fat for storage.

V. There are cultural differences in the proportion of total calories furnished by carbohydrates.

    A. Some populations consume 80% or more of their calories in the form of carbohydrates.

    B. Americans consume about 45% of their calories from carbohydrates.

VI. Current recommendations for Americans are to increase the amount of carbohydrate in the diet.

  A. Complex carbohydrates should be significantly increased in the diet.

  B. Simple sugars should be reduced by one-third.

  C. A liberal supply of carbohydrate is most advantageous to the normal functioning of the body.

Study Guide Assignment

After reading the text assignments and viewing the video lesson, refer to Nutrition: Concepts and Controversies Study Guide and answer questions on the following pages. If there is any difficulty answering the questions, refer to the appropriate chapter of the text. Upon completion of the study guide questions, check the answers with the correct answers in the study guide.

Chapter	Title	Page
4	The Need for Carbohydrate	59
4	A Closer Look	59
4	The Sugars	60
4	Lactose Intolerance	60
4	The Body's Use of Carbohydrates	60
4	Storing Glucose as Glycogen	60
4	Splitting Glucose for Energy	60
4	Maintaining the Blood Glucose Level	61
4	Converting Glucose to Fat	61
4	Diabetes: The Abnormal Use of Glucose	61
4	Carbohydrate in the World Food Supply	62
4	Food Feature: Refined, Enriched and Whole Grain	62
4	Carbohydrate on the Family Table	62
4	Sugar: Is Sugar "Bad" for You?	62
11	The Aspartame Issue	196

Self-Test

After completing all assignments and activities related to this lesson, take the self test on pages 63-66 and 200 of Nutrition: Concepts and Controversies Study Guide. Check the answers in the self-test answers section of the study guide. Review questions that were missed.

LIPIDS

Foreword

This lesson begins with a controversial issue related to lipids. The relationship between dietary lipids, especially cholesterol and saturated fats, and heart disease is presented. All risk factors associated with heart disease, both dietary and non-dietary, are identified. Dietary recommendations concerning the prevention of heart disease are presented.

Included in this lesson is a description of lipids as a class of nutrients, an identification of the functions of lipids in the body, and food sources of lipids.

Objectives

Upon completion of this lesson which includes text assignments, video viewing, and study guide activities, the participant should be able to:

1. Explain the relationship between dietary lipids and cardiovascular disease.
2. Define atherosclerosis as a condition characterized by fat deposits, called plaques, inside the arterial walls.
3. Recognize that cholesterol plays many important roles in the body and is synthesized by the body.
4. Summarize the correlation that exists between blood levels of cholesterol and the incidence of atherosclerosis.
5. Describe the correlation that exists between the level of blood cholesterol and dietary levels of cholesterol and/or saturated fats.
6. Identify animal fats as the source of cholesterol.
7. Specify foods which are particularly rich in cholesterol.
8. Recognize the controversial role of saturated fat and cholesterol in the development of atherosclerosis.
9. Identify vegetable fats as the major source of polyunsaturated fatty acids.
10. Name six non-dietary risk factors associated with atherosclerosis.
11. State the recommended dietary modifications for the prevention of heart disease.
12. Describe lipids as a nutrient class.
13. Discriminate among lipids, carbohydrates, and proteins with respect to their energy values.
14. Identify fatty acids as the building blocks of certain important members of the lipid family.

15. Associate the fluidity of various lipids with the chain length and degree of saturation of the component fatty acids.

16. Differentiate between saturated and unsaturated fatty acids.

17. Define hydrogenation in relation to dietary fats.

18. Define polyunsaturated fatty acids with regard to the number of double bonds in the carbon chain.

19. Recognize that animal and vegetable fats are made up of both saturated and unsaturated fatty acids and specify which predominate in animal fat and which in vegetable fat.

20. Name two lipids that are rich in polyunsaturated fatty acids.

21. Recognize that unsaturated fatty acids are structural components of cell membranes.

22. Name the fatty acid which is considered a dietary essential.

23. Compare linoleic, linolinic and arachidonic acids with regard to the number of double bonds in their carbon chains.

24. Associate peroxidation of fats with rancidity.

25. Identify vitamin E as an antioxidant.

26. List five substances that are classified as lipids.

27. Differentiate among monoglycerides, diglycerides, and triglycerides with regard to the number of fatty acids contained in each.

28. Specify the major role of lipoproteins in the body.

30. Compare the energy value of a molecule of glucose with a molecule of a fatty acid.

31. Explain how the energy value of glucose and fatty acid is related to the hydrogen and oxygen ratio of each.

Text Assignments

1. Before viewing the video lesson, complete the following reading assignments from Nutrition: Concepts and Controversies by Hamilton, Whitney and Sizer.

Chapter	Topic	Page
5	The Lipids: Fats and Oils	92
5	Controversy 5: Diet and Heart Disease	114

2. Review the terms located in the glossary of Chapter 4 of Nutrition Concepts and Controversies, pages 111-112.

Lesson Outline

I. What is the relationship between dietary lipids and heart disease?

A. Atherosclerosis is a condition characterized by the development of deposits or plaques inside the arterial wall.
   1. Plaques cause a restriction of blood flow.
   2. Plaques are rich in cholesterol.

B. Cholesterol is a substance of significant biological importance.
   1. It is synthesized by all animals, including humans.
   2. Cholesterol functions as a component of body structures or compounds in hormones, bile acids, membranes, and lipoproteins.
   3. Cholesterol is provided to the body through both dietary sources and endogenous synthesis.

C. Evidence exists which links cholesterol to the development of atherosclerosis.
   1. High dietary intakes of cholesterol correlate positively with high serum cholesterol levels.
   2. High serum cholesterol levels correlate positively with an increased incidence of atherosclerosis in a number of human populations.
   3. These correlations are not true for all human populations nor for all individuals within a given population.

D. Other dietary lipids may effect the development of atherosclerosis.
   1. High saturated fat consumption is a risk factor for the development of heart disease.
      a. Cholesterol and saturated fats are often found together in foods.
      b. Animal products are sources of saturated fats.
      c. Unsaturated fats are found primarily in plant products, particularly vegetable oils.
      d. High serum cholesterol levels are seen in populations with high dietary intakes of saturated fats.
      e. Decreasing intake of saturated fats tends to lower serum cholesterol levels.
   2. Certain advertisers have over-simplified the relationship between cholesterol, saturated and unsaturated fatty acids, and heart disease.

E. Several risk factors have been identified for the development of heart disease.
   1. The three major risk factors are high serum cholesterol levels, hypertension or high blood pressure, and cigarette smoking.
   2. An individual who possesses all three risk factors is 6 times more likely to experience atherosclerosis than an individual with no risk factors.
   3. Other risk factors include genetic predisposition, obesity, stress, lack of exercise, and a diet high in saturated fat and cholesterol.

F. Persons who are "at risk" for the development of heart disease can reduce their risk. The American Heart Association makes the following recommendations for risk reduction:
   1. Lose weight and/or maintain ideal weight.
   2. Consume less salt and sugar.
   3. Consume smaller meals.
   4. Reduce total intake of cholesterol and fat, and of the fat consumed, increase the proportion of polyunsaturated fat.

II. The lipids are a class of nutrients.

A. The term "lipid" is used to describe both fats and oils.

B. The major role of lipid in the diet is to supply energy or calories to the body.
   1. Lipids have a high fuel value when compared to carbohydrates and proteins. There are twice as many calories per gram of lipid as per gram of carbohydrate or protein.
   2. Lipids also spare proteins from being used as an energy source.

C. Lipids are distinguished by their physical characteristics.
   1. They are insoluble in water, with the exception of certain ones called phosopholipids.
   2. Lipids are soluble in organic solvents, such as benzene and chloroform.
   3. Fatty acids are the building blocks that are common to many lipids.

D. Fatty acids can be solid or liquid at room temperature.
   1. The fatty acid chain length can influence the relative fluidity of a lipid.
      a. Fatty acid chains vary from 4 to 26 carbons in length.
      b. Most naturally occurring fatty acids contain even numbers of carbon atoms.
      c. Long-chain fatty acids contain 14-26 carbons.
      d. Medium-chain fatty acids contain 8-12 carbons.
      e. Short-chain fatty acids contain 4-6 carbons.
      f. Fatty acids in most edible foods have chains 16-18 carbons in length.
      g. Lipids with higher proportions of medium- or short-chain fatty acids tend to be more fluid at room temperature.
   2. The degree of saturation of a fatty acid can influence the relative fluidity of a lipid.
      a. A saturated fatty acid is one which carries the maximum number of hydrogen atoms. Every carbon bond not shared with another carbon is taken up with hydrogen.
      b. An unsaturated fatty acid is one which one or more points of unsaturation occur. This is evidenced by the presence of double bonds.
      c. Hydrogenation is the process through which hydrogen is added to unsaturated fatty acids; this process makes the fatty acids more saturated and solid at room temperature.

d. Unsaturated fatty acids are named according to the number of double bonds they contain.
  - (1) A monounsaturated fatty acid contains one double bond.
  - (2) A polyunsaturated fatty acid (PUFA) contains many double bonds.

E. Unsaturated fatty acids are present in the human body.
  1. Unsaturated fatty acids are derived from many sources.
    a. Lipids from animal sources have a high proportion of saturated fatty acids.
    b. Plant lipids, particularly vegetable oils, have a greater concentration of PUFA and are more fluid at room temperature.
    c. Substantial amounts of polyunsaturated fats are contained in body tissues. PUFAs are found especially in the cell membranes and other organelles.
  2. An essential nutrient is one that cannot be synthesized in the body or cannot be synthesized at a rate sufficient to meet the body's needs.
    a. These nutrients must be supplied in the diet.
    b. Non-essential nutrients are equally important to body functions, but the body has the capability to synthesize varing amounts of these.

F. Peroxidation of unsaturated fatty acids causes them to break down.
  1. The double bond area of an unsaturated fatty acid is unstable.
    a. In the area adjacent to the double bond, the hydrogen atom can be stripped away and an oxygen atom added in its place.
    b. This addition of oxygen is responsible for rancidity of fats and oils.
  2. Vitamin E is an antioxidant.
    a. Vitamin E has the ability to "absorb" oxygen into its structure; it prevents oxidation especially in vegetable oils.
    b. Vitamin E may also function to protect unsaturated fatty acids in human cell membranes.

III. Lipids are classified based on their composition.

A. Lipids contain glycerol and fatty acids.
  1. The most prominent type of lipid is the triglyceride.
    a. It is composed of a glycerol molecule to which three fatty acids are attached.
    b. If the fatty acids which are attached to the glycerol are all different, this is a mixed triglyceride.
  2. A monoglyceride is composed of a glycerol molecule to which one fatty acid is attached.
  3. A diglyceride is composed of a glycerol molecule to which two fatty acids are attached.

B. Lipoproteins are responsible for transporting lipids in circulation.
  1. They are special transport molecules composed of both lipid and protein.

        2. Lipoproteins allow transport of water-insoluble fat substances in a water-based medium, such as blood.
        3. Lipoproteins are part of the structure and integrity of cell membranes.

    C. Steroids and sterols are derived lipids.
        1. These substances are synthesized by both animals and plants.
        2 Their basic structure is a series of complex carbon rings. The parent compound can be varied by the addition of OH (hydroxyl) groups and side-chains.
        3. Cholesterol, which serves as a precursor of bile acids and certain hormones, is a sterol.

    D. Phospholipids serve as vital structural components of the body.
        1. They are composed of glycerol, fatty acids, and a phosphorus-containing group.
        2. The phosphorus group allows for greater solubility in a water-based medium.
        3. Phospholipids are components of lipoproteins, cell membranes, and the myelin sheath of nerve tissue.

    E. Prostaglandins are a group of compounds derived from 20-carbon polyunsaturated fatty acids.
        1. They regulate a number of vital body functions.
        2. Control of blood pressure, muscle contraction, blood clotting, and body temperature are functions of prostaglandins.

IV. Lipids represent a very rich energy source to the body.

    A. The high energy potential of lipids is due to the number of hydrogen atoms present in the molecule.
        1. The ratio of hydrogen atoms to oxygen is high.
            a. Glucose has only two hydrogen atoms for every atom of oxygen.
            b. Fatty acids have many hydrogen atoms when compared to the number of oxygen atoms.
        2. During oxidation, fatty acids, with their high hydrogen ratio, offer more opportunities for oxygen to be added to their molecules.

    B. The energy potential of a nutrient is a function of the amount of oxygen that can be added to the nutrient molecule, or the number of hydrogens present within the molecule.

V. Dietary recommendations for Americans are to reduce lipid consumption.

    A. The typical American diet consists of 40% or more of the total calories from lipids. Animal products are consumed liberally by Americans; these foods are typically high in cholesterol and saturated fats.

    B. There is a relationship between the American diet, serum cholesterol levels, and the incidence of atherosclerosis.

1. The American diet should be altered to reduce lipid consumpton from 40% to 30%.
   a. Total fat consumption should be reduced.
   b. Cholesterol intake should be lowered.
   c. Polyunsaturated fats should be substituted for saturated fats in the diet.
2. What kind of foods should be used to replace the calories formerly provided by fat?
   a. Protein is not a realistic substitute for lipid.
      (1) Animal proteins are themselves high in cholesterol and saturated fats.
      (2) Protein production has a high resource and energy cost.
   b. Carbohydrates are the preferred substitute for lipids.
      (1) Complex carbohydrates, such as breads, cereals, and starchy vegetables, are logical substitutes.
      (2) Sugars are unwise choices due to their concentration of calories; they themselves have been related to the development of heart disease.

Study Guide Assignment

After reading the text assignments and viewing the video lesson, refer to Nutrition Concepts and Controversies Study Guide and answer questions on the following pages. If there is difficulty answering the questions, refer to the appropriate chapter of the text. Upon completion of the study guide questions, check the answers with the correct answers in the study guide.

Chapter	Title	Page
5	Terminology	75
5	Usefulness of Fats	75
5	A Chemist's View of Fats	75
5	Fatty Acids	75
5	Triglycerides	76
5	The Body's Use of Triglycerides	76
5	Separation	76
5	Emulsification	76
5	Digestion and Absorption	76
5	Formation of Liporoteins	77
5	Use of Fat for Energy	77
5	Lecithin and Cholesterol	77
5	How to Raise HDL	77
5	The Fats	77
5	The Meats	77
5	Other Foods	78
5	Food Feature: Defensive Dining	78
5	Diet and Heart Disease	78

Self-Test

After completing all assignments and activities related to this lesson, take the self-test found on pages 80-83 of Nutrition: Concepts and Controversies Study Guide. Check the answers in the self-test answer section, and review questions that were missed.

PROTEIN

Foreword

The basic structural component of all living cells is protein. All plant and animal tissues contain protein, and while it is abundant, many people around the world cannot meet their protein needs while others consume more than they need. Protein is one of the most expensive nutrients that man requires. In this unit, topics that will be addressed include protein consumption in the United States, protein composition, protein synthesis, protein-calorie malnutrition, (PCM), and the functions of protein in the human body.

Objectives

Upon completion of this lesson which includes text assginment, video viewing and study guide activities, the participant should be able to:

1. Compare the importance of protein in the United States with that in developing countries on the basis of per capita consumption in relation to the RDA.
2. Assess the importance of protein in the United States with that in developing countries on the basis of incidence of protein-calorie malnutrition (PCM).
3. Evaluate the importance of protein in the United States with that in developing countries on the basis of the relative contribution of animal versus plant protein sources in the diet.
4. Compare the proportion of grain consumed directly by humans versus the proportions fed to animals and converted to flesh before being consumed by humans in the United States and in developing countries.
5. Distinguish between kwashiorkor and marasmus.
6. Name the three chemical elements that are found in carbohydrates, proteins, and lipids.
7. Identify the element which distinguishes protein from carbohydrate and lipid.
8. Recognize that amino acids are the building blocks of protein molecules.
9. Specify that there are 20 different amino acids commonly found in living organisms.
10. Distinguish between essential amino acids and nonessential amino acids.
11. List five body functions in which protein plays a major role.

12 Describe the role of enzymes in chemical reactions within living cells.

13. Recognize that all body proteins are continually being broken down and resynthesized and that this process requires amino acids to be continually replenished by the diet.

Text Assignments

1. Before viewing the video lesson complete the following reading assignment from Nutrition: Concepts and Controversies by Hamilton, Whitney and Sizer.

Chapter	Topic	Page
6	The Proteins and Amino Acids	123

2. Review terms located in the glossary of Chapter 6 of Nutrition: Concepts and Controversies, pages 146-148.

Optional Reading

Chapter	Topic	Page
7	Controversy 7: Do Athletes Need a Special Diet?	178

Lesson Outline

I. Malnutrition is poor nutritional status resulting from nutrient intakes below the beneficial range.

A. Kwashiorkor is a deficiency disease caused by an inadequate dietary intake of protein in the presence of adequate caloric consumption.

B. Marasmus is a deficiency disease caused by inadequate caloric intake.

C. Protein - calorie malnutrition (PCM) is the term commonly used to describe malnutrition; it reflects the fact that most childhood malnutrition is a combination of both protein and caloric deficiency.

II. Protein is abundant in the United States.

A. The average daily intake of protein (110-120 grams/day) is higher in the United States than recommended. Suggested levels of daily protein consumpton are 56 grams for adult males and 46 grams for adult females. Protein malnutrition is rare in the U.S.

B. A large proportion of American dietary protein is derived from animal sources (42% from flesh, 22% from dairy products, 6% from eggs).
1. About one-third of the average food dollar goes for meat, fish and poultry. Approximately 13% goes for dairy products and eggs.
2. Large quantities (90%) of grains and cereals are used for livestock feed. The livestock and their products are then consumed by humans.
3. Converting plant sources of protein to animal flesh is an inefficient use of edible grains and cereals.

III. Amino acids are the building blocks of protein.

A. All amino acids contain carbon, hydrogen, oxygen, and nitrogen.

B. All amino acids contain an alpha carbon, a carboxyl (acid) group, a nitrogen containing amino group, and an R group (side chain).

C. There are 20 amino acids. (See page 124, Nutrition: Concepts and Controversies).
   1. Eight of the amino acids cannot be synthesized by the body; they must be adequately supplied by the diets of adults and children. These are the essential amino acids.
   2. Histidine is essential for infants and may be essential for adults.
   3. The remaining amino acids are considered nonessential; they can be synthesized by the body.

D. Dietary protein must supply adequate amounts of all the essential amino acids plus sufficient nitrogen to allow for the synthesis of the nonessential amino acids.

IV. Proteins are synthesized from amino acids.

A. Proteins are formed from amino acids that are put together in a specific pattern that is dictated by the DNA of the cells.

B. Protein synthesis occurs only if there is enough energy in the cells, if all essential and nonessential amino acids are available, and if the genetic code is present. Protein synthesis occurs in the ribosomes of the cells.

C. Amino acids are joined by peptide bonds that form between the amino group of one amino acid and carboxyl group of another amino acid.

D. Energy is required to form peptide linkages between amino acids.

V. There are many different proteins in the body as a result of the numerous amino acids that can be linked together.

A. The primary structure of a protein is the sequence of amino acids in the polypeptide chain as dictated by DNA.
   1. If a mistake occurs in the sequence of amino acids, a genetic disorder may occur.
   2. Sickle cell anemia and cystic fibrosis are examples of genetic disorders caused by defective amino acid sequencing.

B. The three-dimensional structure of a protein is the coiling or folding of the peptide chain.
   1. Changes in the three-dimensional structure are called denaturation.
      a. Denaturation occurs if the protein is exposed to heat.
      b. It also occurs if the pH (acidity vs. alkalinity) is changed.
   2. Denaturation does not change the nutritional value of the protein.

VI. Proteins have a variety of functions in the body.

- A. The most vital function of protein is to build, repair, and maintain tissues.

- B. Proteins are structural agents in muscles, bone, and connective tissue.

- C. Proteins regulate body processes and reactions.
  1. Enzymes are proteins which speed up the rate at which reactions occur.
  2. Some hormones are proteins which stimulate or inhibit specific body functions. Examples of proteins are insulin, thyroxin, and growth hormone.

- D. Proteins are used for transporting body substances.
  1. Red blood cells contain a protein, hemoglobin, which transports oxygen in the blood.
  2. Iron is transported in a protein called transferrin.
  3. Lipids are transported as a lipid-protein complex called lipoproteins.

- E. Proteins serve a protective function.
  1. Proteins called antibodies provide resistance against harmful microorganisms.
  2. Proteins called buffers help protect against shifts on the acid-base balance of body fluids.
  3. Some proteins serve to regulate the distribution of body fluids.

- F. Amino acids can be used for energy when the nitrogen portion is removed.
  1. Protein is used for energy when there is an excess of dietary protein.
  2. When calories are provided in inadequate amounts from carbohydrate and lipid, amino acids will be used for energy.
     - a. The conversion of amino acids to be used as energy occurs even when amino acids are needed for protein synthesis.
     - b. Even the body's own protein-containing tissue will be degraded for energy if there is an inadequate amount of calories supplied in the diet.
  3. If one or more amino acids is not present in the cell, protein synthesis is halted.
     - a. All of the amino acids must be present in the cells, in adequate amounts, for protein synthesis to occurs.
     - b. The essential amino acids are most critical because they cannot be synthesized in the body.
     - c. When the essential amino acids are in low supply, protein synthesis is limited because the body cannot store some amino acids while waiting for the others to be provided.

Study Guide Assignment

After reading the text assignments and reviewing the lesson, refer to Nutrition: Concepts and Controversies Study Guide and answer questions on the following pages. If there is difficulty answering the questions, refer to the appropriate chapter of the text. Upon completion of the study guide questions, check the answers with correct answers in the study guide.

Chapter	Title	Page
6	Structure of Protein	93
6	Amino Acids and Their Side Chains	93
6	Essential and Nonessential Amino Acids	93
6	Protein: Strands of Amino Acids	93
6	Specificity of Protein Structure	93
6	Denaturation of Protein	93
6	The Roles of Protein	93
6	The Body's Handling of Protein	94
6	Foods Proteins: Quality and Use	95
6	The Protein RDA	95
6	Food Sources of Protein	96
6	Food Feature: Meeting Daily Protein Needs	96
6	Protein for the Vegetarian	96
6	Protein-Calorie Malnutrition	96
6	Kwashiorkor	96
6	Marasmus	96
6	Protein Excess	96
7	Do Athletes Need a Special Diet	113

Self-Test

After completing all assignments and activities related to this lesson, take the self-test found on pages 99-101 and 119 of Nutrition: Concepts and Controversies Study Guide. Check the answers in the self-test answers section, and review questions that were missed.

ENERGY

Foreword

The process of energy utilization is a complex one. This unit focuses on the processes involved in the release of energy from foods and the use of this energy to supply the body's needs. Digestion, absorption, and utilization of nutrients are discussed.

Objectives

Upon completion of this lesson, which includes text assignment, video viewing, and study guide activities, the participant should be able to:

1. Associate the energy received from dietary carbohydrates, proteins and lipids as the source of energy for the body.
2. Recognize that carbohydrates, proteins, and lipids must be broken down (digested) into their smallest components before being absorbed into the body.
3. Define the three categories of energy expenditure in the body.
4. Conclude that food, which contains energy, is digested into small molecules, absorbed, and transported to the cells where energy is ultimately used.
5. Identify the molecule which captures the energy released from nutrients.
6. Define ATP as the fuel source for cellular "work."
7. Distinguish between calorie and Calorie (kilocalorie) in terms of the amount of energy each represents.
8. Compare the physiological fuel values of carbohydrates, proteins, and lipids.
9. Associate excess energy (calorie) intake with fat storage.
10. Identify calorimetry as the measurement of energy expended by the body.
11. Differentiate between direct and indirect measures of energy expenditure by the body.
12. List the factors which influence the rate of basal metabolism.
13. Describe how various factors influence the rate of basal metabolism.

Text Assignments

1. Before viewing the video lesson, complete the following reading assignment from Nutrition: Concepts and Controversies by Hamilton, Whitney, and Sizer.

Chapter	Topic	Page
7	Energy Balance: Feasting, Fasting, Loafing, Exercise	159

2. Review the defined terms located in the glossary of Chapter 7 of Nutrition: Concepts and Controversies, page 176.

Additional Information

The following information on digestion is included to supplement the text and create a better understanding of how food provides the energy needed by the body. Information on the digestion of carbohydrates, fats, and proteins is located in the respective chapters in Nutrition: Concepts and Controversies.

How does the body use food?

Consider briefly what happens to food after it is eaten. The body is made up of millions of tiny units called cells. In order to live and grow, all of the body cells need nutrients which are found in foods. The process by which food is changed into substances that the cells can use is called digestion.

I. Digestion begins in the mouth.

When food is placed into the mouth and chewed, the grinding action of the teeth causes the food to be reduced in size. Saliva flows from the salivary glands and mixes with the food to form a watery mass. Saliva is a digestive juice which contains water, mucous, and a digestive enzyme. Digestive enzymes are substances that cause the chemical breakdown of foods.

When they come in contact with saliva, carbohydrates begin to change. Some of the starch changes into sugar and the sugar then dissolves. Thus, carbohydrates begin digestion while still in the mouth.

What happens to other foods while they are in the mouth? Nothing, except that they please the taste buds and the teeth grind them. Mechanical digestion (chewing and grinding) begins in the mouth.

When swallowed, the food mass, called a bolus, passes into a long tube known as the esophagus. A series of ring-like muscles squeeze the bolus along until it reaches the stomach.

II. Digestion continues in the stomach.

Strong muscles in the stomach churn the bolus into a thick paste. A strong acid, hydrochloric acid, and a powerful enzyme begin to change the protein in foods. The proteins are split into smaller, more soluble parts. Here they are made ready for the final phase of digestion in the small intestine.

Meat, milk, and grain proteins are only partially digested as they move into the small intestine. Fats leave the stomach slowly. For this reason, fats are often called satisfying foods because they delay the empty feeling in the stomach. Fats are not digested until they reach the small intestine.

III. Digestion is finalized in the small intestine.

Two organs are connected to the upper part of the small intestine. The larger one is the pancreas; the other is the gall bladder (which is connected with the liver). These organs, along with tiny glands in the walls of the small intestine, supply juices and enzymes that complete the digestion of food. As the food mass enters the small intestine, some of the juices and enzymes begin to change the fats into tiny droplets. Others finish the work of digesting the proteins and carbohydrates. At this point food has been broken into its simplist nutrient components. All that remains is a liquid that contains amino acids, digested fats called fatty acids and glycerol, and simple sugars.

Minerals and vitamins in foods do not have to be changed by digestion. As the other nutrients are broken down by enzymes, the vitamins and minerals dissolve and pass directly into the blood.

All digested nutrients pass through the intestinal wall and make their way into the blood stream. In most foods there are some portions that the enzymes cannot digest. This undigestable part is called roughage. Roughage and by-products of digestion pass into the large intestine and from there leave the body.

Lesson Outline

I. Energy is essential to life.

   A. All body processes require chemical energy.

   B. Food is a source of chemical energy.
      1. Specialized cells line the gastrointestinal tract.
         a. These cells assist in digestion and absorption of food and nutrients.
         b. These specialized cells also connect the gastrointestinal tract with blood and lymph (the transport system of the body).
      2. Food is not considered to be within the body until it is absorbed into the circulatory system to be carried to the cells and utilized.

II. Digestion is the process in which carbohydrates, proteins, and lipids are broken down into constituent molecules. Vitamins and minerals have to be released from the substances to which they are bound.

   A. Mechanical digestion separates food into small particles but does not disrupt the chemical bonds.
      1. The chewing action of the teeth reduces food into smaller pieces.
      2. Peristalsis, churning of the esophagus, stomach, and small intestine, also reduces the size of food.

   B. Chemical digestion involves breaking the chemical bonds in food.
      1. Hydrolysis is the splitting of chemical bonds by removing a molecule of water.
      2. Enzymes are secreted into the digestive tract. Enzymes catalyze the reactions that break chemical bonds.

C. In carbohydrate digestion, starch and disaccharides (sucrose, lactose and maltose) are broken down into monosaccharides.
  1. Carbohydrate digestion begins in the mouth.
    a. Mechanical digestion begins when food is chewed.
    b. Salivary amylase breaks some starch into dextrins.
  2. Carbohydrate digestion continues in the stomach.
    a. Mechanical separation of carbohydrate continues. Salivary amylase activity continues for a short time until it is deactivated by acid in the stomach.
    b. Hydrochloric acid has a limited effect on the hydrolysis of starch.
  3. The final phase of carbohydrate digestion occurs in the small intestine.
    a. Pancreatic amylase breaks dextrins into the disaccharide, maltose.
    b. Disaccharides are split by enzymes called disaccharidases. Disaccharidases are synthesized in the cell membrane of the intestinal wall.
      (1) Sucrase cleaves sucrose into the monosaccharides, glucose and fructose.
      (2) Lactase cleaves lactose into the monosaccharides, glucose galactose.
      (3) Maltase cleaves maltose into two glucose units.

D. Protein digestion involves the breakdown of proteins into their constituent amino acids.
  1. The mechanical digestion of protein begins in the mouth.
  2. In the stomach, gastric protease splits long peptide chains into proteoses and peptones.
  3. The small intestine is the final phase of protein digestion.
    a. Pancreatic and intestinal proteases split the majority of proteins into dipeptides (two amino acids linked together) and free amino acids.
    b. Dipeptidases present within the membrane of the intestinal walls break dipetides into individual amino acids which are absorbed.

E. Lipid digestion involves the breakdown of triglycerides to glycerol and fatty acids.
  1. In the mouth, mechanical digestion of lipids begins when fat-containing foods are chewed.
  2. In the stomach, naturally emulsified lipids are acted upon by gastric lipases.
  3. The small intestine is the major site for digestion of unemulsified lipids.
    a. Bile is manufactured by the liver and stored in the gall bladder. Bile helps to disperse large globules into finer particles. This process is called emulsification.
    b. Pancreatic and intestinal lipases further act on lipid molecules to alter them chemically.
    c. There are four end-products of lipid digestion.
      (1) Monoglycerides predominate, also, free fatty acids and glycerol are present.
      (2) Lesser amounts of diglycerides are produced.

d. The end-products of lipid digestion are regrouped into micelles; these are tiny particles containing the end products of lipid digestion, complexed with bile.
    (1) Hydrophobic regions (more fat-soluble regions) of the end-products are oriented toward the inside of the micelle.
    (2) Hydrophilic regions (more water-soluble regions) of the end-products are oriented toward the outside of the micelle.

III. Absorption is the movement of the end products of digestion through the cells of the intestinal wall and into circulation.

A. Villi are finger-like projections that line the intestinal wall.
    1. Villi increase the surface area of the intestine.
    2. Microvilli, located on the surface of the villi, further increase the surface area of the intestine.

B. Nutrients are absorbed through the membranes of the villi.

VI. Blood is the vehicle of transportation and distribution of nutrients in the body.

A. Interstitial fluid acts as a carrier agent between the blood and the cells.

B. Nutrients dissolve in the blood and are carried to the cells. Waste products move out of the cells and are carried away by blood.

C. Energy is required for much of the nutrient-waste exchange between the cells and body fluids.

V. Energy is the ability to do "work."

A. There are three categories of energy expenditure.
    1. Basal metabolism is the energy needed to sustain essential activities of the cell when the body is at complete rest.
        a. Basal Metabolic Rate (BMR) is the rate at which energy is being used by the cells for essential activities.
        b. Essential activities include breathing, kidney function, brain function, respiration, and normal heart beat.
        c. Basal metabolism requires that the cells extract energy from the energy-yielding nutrients and use the energy to fuel ongoing cellular processes.
            (1) BMR is measured when the body is at complete physical, mental and digestive rest.
            (2) BMR accounts for the largest portion of the body's energy needs.
    2. Energy is required for physical activity, rest, and work.
        a. Physical activity involves the interaction of nerves and muscles.
        b. The central nervous system stimulates muscle activity.
        c. All neuromuscular actions require energy.
    3. Specific Dynamic Action (SDA), or thermogenic effect of food, is the energy required for digesting food and absorbing the nutrients. SDA comprises approximately 10% of the body's energy need.

B. Energy is released from nutrient-containing molecules.
   1. Chemical bonds of nutrient-containing molecules are disrupted and energy is released.
   2. Energy is constantly being freed from nutrients by reactions in the body's cells.
   3. Most of the released food energy is recaptured in the high-energy bonds of adenosine triphosphate (ATP).
      a. Food energy that is not recaptured in ATP is converted to heat.
      b. ATP conversion represents a source of heat for the body.
   4. ATP provides energy capable of doing "work" in the body.

C. Carbohydrates, proteins, and lipids from food provide energy to the body.
   1. Food energy is measured in calories or kilocalories.
      a. A calorie or kilocalorie is the amount of heat required to raise the temperature of 1 kilogram (just over a liter) of water by 1 degree celcius.
      b. The word Calorie is capitalized when referring to the nutritional kilocalorie.
   2. Energy values of foods are determined by using a device called a "bomb calorimeter."
      a. Food is completely burned (or oxidized) within the inner chamber of the bomb calorimeter; the degree of temperature change in the layer of water that surrounds the inner chamber represents the amount of energy released from the food.
         (1) Carbohydrate contains 4.1 Calories per gram.
         (2) Lipid contains 9.45 Calories per gram.
         (3) Protein contains 5.65 Calories per gram.
      b. Energy values obtained from a bomb calorimeter must be "corrected" since the body does not respond to food in the same way as a bomb calorimeter.
         (1) The body cannot use nitrogen as a source of energy, so protein energy values must be adjusted.
         (2) The body does not completely digest and absorb all nutrients; therefore, there is a slight loss of energy.
      c. Physiological fuel values are adjusted energy values for the nutrients.
         (1) Carbohydrate provides 4 Calories per gram.
         (2) Lipid provides 9 Calories per gram.
         (3) Protein provides 4 Calories per gram.
   3. Energy needs are equal to the body's energy expenditure in BMR, activity and SDA.
   4. Excess intake of energy (calories) results in storage of fat.

E. The energy expended by the body is determined by calorimetry.
   1. Direct calorimetry is a measurement of the amount of heat given off by the body.
      a. This is a very accurate method for measuring energy expenditure.
      b. It is a relatively expensive method of determining energy expenditure because it requires use of special chamber.
   2. Indirect calorimetry is a measurement of the amount of oxygen consumed and carbon dioxide expelled by a subject.

a. The utilization of nutrients in cells requires oxygen; the by-product is carbon dioxide.
b. The measurement of oxygen consumption and carbon dioxide exhalation will reflect the amount of energy being utilized by the cells.
c. Each liter of oxygen inhaled represents about 5 Calories being used in the cells.

Study Guide Assignment

After reading the text assignments and viewing the video lesson, refer to Nutrition Concepts and Controversies Study Guide and answer questions on the following pages. If there is difficulty answering the questions, refer to the appropriate chapter of the text. Upon completion of the study guide questions, check the answers with the correct answers in the study guide.

Chapter	Title	Page
7	Introduction	110
7	Carbohydrate	110
7	Fat	110
7	Protein	110
7	Feasting	110
7	Fasting	110
7	The Low-Carbohydrate Diet	111
7	The Protein-Sparing Fast	111
7	Moderate Weight Loss	111
7	Food Feature: Counting Calories	111
7	Energy Output	112
7	Total Energy Output	113
7	Increasing Energy Output	113

Self-Test

After completing all assignments and activities related to this lesson, take the self-test on pages 115-118 of Nutrition: Concepts and Controversies Study Guide. Check the answers in the self-test answers section, and review questions that were missed.

WORLD FOOD I

Foreword

Deficiencies of nutrients cause specific symptoms and illnesses. Malnutrition is the term used to express the general effects on the body of the unavailability of a nutrient or nutrients. Depending upon which nutrient(s) is involved, the deficiency will cause various symptoms. Yet, the final effect of malnutrition is undeniable.

Approximately 12,000 individuals worldwide die of malnutrition each day. Furthermore, malnutrition occurs not only in the poorest nations of the world but also in the wealthiest. In this unit, the methods used to determine the nutritional status of people will be examined and the conditions associated with particular nutrient deficiencies will be discussed.

Objectives

Upon completion of this lesson which includes a text assignment and video viewing, the participant should be able to:

1. Differentiate between primary nutrient deficiencies and secondary nutrient deficiencies.
2. Distinguish between a biochemical lesion and an anatomical lesion.
3. Associate biochemical tests for nutrient status with the examination of certain tissues or fluids.
4. Recognize that the presence of an anatomical lesion is determined by a clinical examination.
5. Identify anthropometric measurements as being valuable in evaluating the nutritional status of children.
6. Recognize that dietary evaluation is only a single indicator of nutritional status.
7. Compare between kwashiorkor and marasmus as forms of protein-calorie malnutrition (PCM).
8. List reasons that children are particularly susceptible to PCM.
9. Evaluate the interaction between malnutrition and disease.
10. Identify the major symptoms exhibited in vitamin deficiencies.

Text Assignments

1. Before viewing the video lesson, complete the following reading assignment from Nutrition: Concepts and Controversies by Hamilton, Whitney and Sizer.

Chapter	Title	Page
9	Vitamin A	224
9	Vitamin D	229
9	Thiamin	234
9	Riboflavin	237
9	Niacin	237
9	Vitamin B-12	244
9	Vitamin C	249
10	Iodine	291
10	Iron	292

2. Review the following terms:

Lesion - structural or functional alteration caused by disease.

Night Blindness - vitamin A deficiency symptom.

Scurvy - vitamin C deficiency disease.

BeriBeri - thiamin deficiency disease.

Pellagra - niacin deficiency disease.

Pernicious Anemia - vitamin B-12 deficiency disease.

Kwashiorkor - deficiency of dietary protein in the presence of adequate calorie intake.

Marasmus - deficiency of both protein and calories, starvation.

Lesson Outline

I. There are many problems associated with food economics.

A. Industrialized nations are not exempt from food problems related to their economic conditions.
  1. Food is reasonably plentiful, but there are pockets of hunger.
  2. Examples include the U. S., Canada, Western Europe, and Japan.

B. Food supply problems have been common in nations with a centrally placed economy.
  1. These nations appear to have dealt effectively with problems of malnutrition.
  2. Examples include Taiwan, Vietnam, People's Republic of China, and North and South Korea.

C. Oil-producing nations also experience food supply problems due to their economy.
  1. In these nations, there is an uneven distribution of wealth.
  2. Examples include the Middle East nations.

D. The food supply of less developed nations is greatly influenced by the economic climate.
  1. These countries are poor in natural resources and development capital.
  2. There is an uneven distribution of wealth.
  3. A number of African nations have been devastated by food shortages.
  4. Chronic undernutrition and episodes of acute malnutrition are common.

II. Malnutrition encompasses different categories or origins of nutritional problems.

A. Deficiency diseases are a reflection of severe malnutrition.
  1. A primary deficiency is caused by an inadequate dietary supply of a nutrient.
    a. Undernutrition, or not consuming enough food, is usually the cause.
    b. If the diet lacks a specific essential nutrient, a primary deficiency will soon occur.
  2. A secondary deficiency is caused by something other than diet, such as a disease condition that reduces absorption, increases excretion, or causes destruction of a nutrient.
    a. This alteration may be caused by genetic factors, such as an enzyme deficiency.
    b. It may also be caused by environmental factors; an example is an infection.

B. Events that occur in the body during a deficiency are the same regardless of whether the cause is primary or secondary.
  1. Initially there is a gradual decrease in the tissue levels of the nutrient, and biochemical lesions result.
  2. Biochemical lesions are not visible and must be measured by chemical tests.
    a. Biochemical lesions represent the earliest kind of deficiency symptom that can be detected.
      (1) An example is thiamin deficiency. A biochemical lesion means that there is a breakdown or block in the reactions in which thiamin serves as a coenzyme.
      (2) There is an accumulation (in blood and urine) of substances that normally would be broken down. In thiamin deficiency an accumulation of pyruvate in body fluids results.
    b. A biochemical test involves taking samples of body tissues (like blood and urine).
  3. Anatomical lesions appear after biochemical lesions have occurred.
    a. The lesions are visible on the surface of the body.
    b. They are usually reflected in changes in skin, hair, eyes, mouth, and other tissues with rapid turnover.
    c. They are easily observed by clinical examination.

III. Assessment of nutritional status involves the evaluation of anthropometric, biochemical, clinical, and dietary data.

A. Ideally, deficiencies should be identified at the earliest point, and certainly before they progress to the stage of an anatomical lesion.
  1. Methods used in nutritional evaluation have weaknesses and are subject to problems.
  2. Conditions, such as those in field studies, do not always allow for the use of preferred evaluation methods.

B. Methods for evaluating nutritional status of individuals should include all four assessment criteria.
   1. Biochemical analysis is the measurement of the quantities of nutrients or other substances which reflect nutrient levels in body fluids or tissues.
      a. This measurement detects nutrient deficiencies at the earliest possible stage. Also, this is the best method of determining which nutrient is deficient.
      b. For this kind of test, a sample of urine, blood, or tissue (such as liver or bone marrow) must be obtained.
         (1) Urine is easy to obtain and store.
         (2) Blood is easily obtained, and this sample is especially indicative of nutrient deficiencies.
   2. Clinical examination involves trained individuals who evaluate the condition of eyes, ears, skin, hair, mouth, teeth, thyroid gland, and lower extremeties.
      a. Clinical observations are not as sensitive as biochemical analyses because clinical exams cannot detect very early deficiency symptons.
      b. Clinical symptoms are not necessarily specific for single nutrients.
   3. Anthropometric measurements are body measurements such as height and weight, chest, arm and head circumference, and skinfold thickness.
      a. Anthropometric evaluation gives an indication of whether or not growth is progressing normally.
         (1) If growth is normal, nutrition is likely to be adequate.
         (2) Genetic background will influence an individual's height, and weight, and chest, arm and head circumference. This tends to make anthropometric measurements less reliable.
      b. Anthropometric measures are most beneficial when they are repeated over a period of time and are used to evaluate any changes that have occurred during that period of time.
   4. Dietary evaluations are not sensitive tools for determining deficiencies, they can only suggest deficiencies.
      a. Dietary evaluations can be valuable when used in combination with other assessment methods.
      b. Dietary data are obtained by keeping food intake records or by interviewing individuals directly. The most common dietary evaluation is the 24-hour recall.
      c. Dietary data must be evaluated for nutrient content.
         (1) Scoring techniques are sometimes used.
         (2) The approximate intake of nutrients is calculated and then compared with the recommended levels of intake.

IV. Protein-calorie malnutrition (PCM) includes kwashiorkor and marasmus.

A. Kwashiorkor is a deficiency of dietary protein though calories are adequate.
   1. Kwashiorkor most often develops after a child is weaned from the breast.
   2. The foods consumed after weaning are low in protein.

B. Marasmus is a deficiency of both calories and protein. It is simply starvation.
   1. Most cases of PCM are of the marasmus type.
   2. Individuals suffering from marasmus are literally living on their own body tissues.
   3. Dietary protein (if provided) would be used as a fuel source only.

C. The symptoms of PCM reflect a decline in energy to maintain normal physiological functions of the body.
   1. Kwashiorkor is characterized by fluid accumulation (edema) in the limbs and abdomen. This represents a severe physiological disturbance within the body.
   2. With the exception of edema, symptoms of marasmus and kwashiorkor are similar.
      a. Other symptoms include muscle wasting, skin lesions, listlessness, infection, hair changes, and failure to grow in children If not reversed, severe PCM will result in death.

D. Children are particularly susceptible to PCM.
   1. Children have proportionally greater needs for protein, calories, and most other nutrients.
   2. It is suggested that infantile PCM is a cause of mental retardation; however, studies are unclear. There does appear to be behavioral changes associated with PCM.
   3. Infant mortality is a good indicator of nutritional problems in a particular region. The rate of infant death is much higher in less developed than in developed countries.
      a. High infant mortality rates indicate the interaction between malnutrition and disease.
         (1) A child who is marginally nourished may succumb to an acute malnourished state by the presence of disease.
         (2) A nutrient deficiency lowers the resistance to infection and disease.
      b. Recovery from PCM requires hospitalization and close monitoring of the victim during and after recovery.
      c. Rehabilitated children frequently return to conditions which reproduce the malnutrition.
         (1) Families may lack economic resources to buy appropriate foods.
         (2) High-protein foods are usually given first to family workers who provide for the family's economic support.

V. Frequently malnourished children suffer from a number of specific nutrient deficiencies due to a generally inadequate diet.

A. Vitamin A deficiency is a leading cause of certain types of blindness.
   1. Night blindness is the inability to see in dim light. This is an early symptom of vitamin A deficiency. Night blindness is reversible if vitamin A is administered.
   2. The deficiency state progresses from night blindness to dry and keratinized corneal tissue. This leads to eye infection, which in turn produces xerophthalmia, which eventually causes blindness.

3. The determination of vitamin A status is difficult because blood levels remain normal until liver storage is depleted. By the time the deficiency is demonstrated, it has reached an advanced state and the symptoms worsen rapidly.

B. An iodine deficiency manifests itself in a condition known as goiter.
   1. Goiter is the enlargement of the thyroid gland.
   2. In-utero or infant deficiency of the goiter produces cretinism which is a condition characterized by dwarfism, behavioral alterations, and retardation.
   3. Iodine is found in ground water except in certain areas of the world. South America and the Himalayas have low levels of iodine in the ground water.
   4. In the U. S., salt is fortified with iodine.

C. Iron is probably the most widely known of all the essential nutrients.
   1. Approximately 5 to 17% of males and 10 to 50% of females in Africa, Asia and South America suffer from iron deficiency.
   2. The result of iron deficiency is anemia.
      a. In iron deficiency, oxygen is transported less efficiently in the body.
      b. Small, pale, red blood cells result.
      c. Nails become concave or "spoon-shaped."
   3. Iron deficiency anemia causes general weakness and a reduced ability to perform physical work. It is also a predisposing factor for infection.
   4. In tropical countries, anemia may be caused by a parasitic infection, such as hookworm.
   5. Few foods are rich in iron. Fortified or supplemental iron is recommended for high risk groups such as pregnant women and adolescent females.

D. A deficiency of Vitamin C results in the development of scurvy.
   1. The deficiency effects connective tissue; thus, all tissues are effected.
   2. Early symptoms include gum inflammation and slow wound healing. These symptoms can be reversed in seven to ten days after the addition of vitamin C to the diet.
   3. Scurvy is mistakenly regarded as a disease of the past. Infantile scurvy may occur in bottle-fed infants whose formulas have been sterilized by heating, as heat destroys vitamin C.
      a. The "frog" position is characteristic of infantile scurvey. Arms and legs are very tender and inflamed; movement is painful.
      b. An enlargement appears at the junction between cartilage and bone in the rib area. This condition is called scorbutic rosary.

E. A thiamin deficiency results in the development of beriberi.
   1. The symptoms of thiamin deficiency are related to the role of thiamin in energy metabolism.
      a. "Pitting" edema is the classic symptom of beriberi.
      b. Poor neuromuscular control is also a symptom.
      c. The heart also becomes enlarged.
   2. Symptoms are reversed after two to three weeks of thiamin supplementation.

F. Niacin deficiency is common among populations who use corn as a staple food.
  1. A deficiency of niacin results in the development of pellagra.
    a. Refining corn removes most of its niacin.
    b. Corn is high in leucine; this may interfere with niacin utilization by the body.
  2. The 4-Ds of pellagra are diarrhea, dermatitis, dementia, and death.
  3. Glossitis, or inflamed tongue, is also a symptom of pellagra.

G. There is no specific deficiency disease for riboflavin; however, a variety of symptoms are characteristic of the disease.
  1. Glossitis is common.
  2. Scaly dermatitis also occurs.
  3. Cheilosis, cracks in the corners of the mouth, is a condition associated with riboflavin deficiency.

H. A deficiency in Vitamin B-12 results in the development of pernicious anemia.
  1. Often, the deficiency of Vitamin B-12 is caused by malabsorption of the nutrient.
    a. Malabsorption of Vitamin B-12 may be caused by an infectious disease.
    b. It may also be caused by failure to secrete the intrinsic factor which is necessary for the absorption of vitamin B-12.
  2. In Vitamin B-12 deficiency, the red blood cells are different from those seen in iron deficiency anemia.
    a. Red blood cells appear larger than normal. The large red cells are called macrocytes.
    b. Red blood cells are deeply colored.

I. A deficiency of Vitamin D results in the development of rickets in children and osteomalacia in adults.
  1. Rickets are seen primarily among children who have little or no dietary source of vitamin D and who are seldom exposed to sunlight.
  2. Because vitamin D is absent, calcium absorption and utilization are effected. As a result, bones do not properly calcify.
  3. The symptoms of rickets are pronounced in bone tissue.
    a. The legs become bowed because the bones bend under the weight of the growing child.
    b. The richatic rosary becomes evident when the cartilage-bone junction of the ribs begins to swell.

There is no study guide assignment for this section.

WORLD FOOD II

Foreword

The previous lesson focused on the effects of malnutrition. This lesson introduces issues that surround the alleviation of malnutrition throughout the world and the complications involved in reaching this goal.

To many, the world food problem is simply a matter of too many people and not enough food. As will be seen in this unit, the world food problem is anything but simple. Instead, it is a complex matter.

To provide insight into the world food problem, four specialists will present their views on the subject. These specialists are Dr. Ken Wilkenson (demographics), Dr. Rustum Roy, (material resources), Dr. Mackenzie (international agriculture), and Dr. Carole Christopher (food distribution).

Objectives

Upon completion of this lesson which includes reading assignments, video viewing, and study guide activities, the participant should be able to:

1. Specify the percentage of the world's population that is undernourished.
2. Define exponential growth in terms of population.
3. Conclude that the world food shortage involves problems other than overpopulation.
4. Recognize that, on a worldwide basis, both birth and death rates have fallen.
5. Briefly define the Malthusian solution as it relates to population growth.
6. Recognize that the U. S. utilizes a disproportionate share of much of the world's resources, including food.
7. Discuss how reliance upon cash crops affects the nutritional well-being of less developed nations.
8. Explain the hypothesized effects of the "green revolution" on the world food problem.
9. Define the "lifeboat" and "triage" solutions for the world food problem.

Assignments

1. This lesson contains no text assignment; instead, choose one of these three areas to do supplementary reading:
    a. Find and read articles explaining the impact of the "Green Revolution."
    b. Research the "Malthusian Theory" and its relativity to today's population growth and food supply.
    c. Read the book, Diet for a Small Planet, by F. M. Lappe.
    d. Read Controversy 6: World Hunger, pages 149-156 in Nutrition: Concepts and Controversies.

2. From the lesson outline review the following terms:
    a. Malthusian theory,
    b. Lifeboat concept,
    c. Triage theory, and
    d. Green revolution.

Lesson Outline

I. At least 500 million people in today's world are malnourished, and the number is growing.

    A. Growth problems exist worldwide.
        1. Exponential population growth is occurring in many areas of the world.
        2. Exponential growth in consumption of non-replenishable resources is occurring as well.

    B. The world food problem is more than a simple shortage of food.
        1. Approximately 25% of the world's population is undernourished.
        2. There is presently enough food to feed everyone.

II. The population has a direct effect on the world's food supply.

    A. There have been three periods of rapid population growth.
        1. The first period was millions of years ago when tools were invented.
        2. The second period was 10,000 years ago when agriculture was introduced.
        3. The third period is happening now. Relatively speaking, this period is experiencing the greatest increase ever.
            a. In the Christian era there were less than one-half billion people in world.
            b. In 1800, there were 1 billion people.
            c. In 1930, there were 2 billion people.
            d. In 1970, 4 billion people inhabited the world.
            e. These figures reflect an increase of 2% per year.

    B. The "demographic transition" has brought about this change.
        1. Death rates have fallen; birth rates have also fallen but not as rapidly as death rates.
        2. In more developed countries, the birth rates have fallen to a point just above the death rates.
        3. In approximately 140 of the less developed countries (L.D.C.), birth rates have fallen as quickly as death rates.
            a. Two-thirds of total world population live in less developed countries.
            b. By the end of this century, at least three-fourths of world's population will be in L.D.C.

C. Food production is keeping pace with population growth.
1. Food production is increasing in both developed and less developed countries. The actual increase is greater in less developed countries.
a. The population is growing more rapidly in less developed nations; thus, per capita food resources have not increased.
b. Birth rates are down in developed countries, so food resources have greatly increased on a per capita basis.
2. The Malthusian Dilemma suggests that population growth is controlled by the growth in food supply.
a. The Malthusian theory states that the population of the world will be held in check by limits of the earth's ability to produce food.
(1) The population will increase only to the limits of the food supply.
(2) Natural and "man-made" disasters will reduce the population
b. Many believe that the era of the Malthusian checks and balances is in existence.

D. There is enough food produced in the world; everyone (on a per capita basis) should have an adequate diet, but many do not. There are three reasons for the unequal distribution of food.
1. There is maldistribution among nations of the world. The poorest nations lack resources to grow or purchase adequate food.
a. Approximately 460 million people (one-third of the world) have diets that are inadequate in calories and protein.
b. In more developed nations, three percent of the population experience hunger.
c. In less developed nations, 25% of the population experience hunger. In the Far East, 30% of the population have low protein and calorie intakes.
2. The inequitable distribution of incomes and food is stratified within nations.
a. Increased income has been associated with greater per capita food consumption.
b. On a worldwide basis, the average daily caloric intake for low income groups is 2,000 calories, but for the higher income groups it is 3,200 calories.
3. There are temporary shortages in the food supply due to weather, famine, calamity, and political upheaval.
a. Those who are continually undernourished in calories or protein are more vulnerable to the acute nutritional stresses of famine.
b. The wealthy usually survive famines and other food shortages.

III. Resource are utilized on a global scale. (Dr. Rustum Roy)

A. Food is just one of many resources that are inequitably distributed.

B. Food is a valuable resource.
1. Resources are interconvertible and interchangeable.
2. Food should be considered in the context of total resource utilization.
3. All resources are increasing in utilization and/or consumption.
4. Resources are relied upon by all nations for economic development and growth.

C. Wealth is related to resources available on a per capita basis. Resources are equated with wealth.
  1. Wealthy countries are using more resources per capita.
  2. The U. S. and other developed nations have depleted their own resource bases and have begun to use the world's resources.
    (a) These nations have access to the world's resources because they are economically and politically powerful.
    (b) Resources are equated with wealth, and wealth is equated with power.

D. The gap between the rich and the poor in the world is increasing.
  1. There is an inequity in resource utilization.
  2. The terms for purchasing manufactured goods are unfavorable for less developed countries.
  3. All resources should be redistributed.

E. The exponential increase in resource utilization, both per capita and total, is unsustainable.
  1. There is a finite amount of most resources; it is physically impossible to increase usage indefinitely.
  2. Depletion of resources is as much a problem for the world as is the population burden. Neither can continue.

F. A possible solution could be a bargain between the developed and developing nations.
  1. The lesser developed countries bring the population under control.
  2. The developed countries bring resource consumption under control.

IV. Food distribution efforts need to continue. (Dr. Carole Christopher)

A. It is a myth that the U. S. "feeds the hungry people" in the world.
  1. Approximately 95% of the U. S. agricultural surplus goes into international export markets.
  2. Only 5% of the surplus is food aid; much of this is divided among political allies.
  3. Food aid is not a high priority in the U. S.

B. Less developed countries export significant amounts of agricultural produce to Western Europe, Japan, the Soviet Union, the U.S.A., and other developed countries.
  1. Of the grain products, 75% of the imports of Japan and Western Europe are used to feed livestock.
  2. Ironically, the U. S. is one of five leading food importers; two-thirds of what the U. S. imports is from the less developed nations.
  3. Animal and plant products are produced by less developed nations to sell to more developed nations. These products could be used by the L.D.C. to meet their own food supply needs.

4. The Legacy of Colonialism stipulates that the best land is in less developed countries. This land is used to produce cash crops. Cash crops are those which are produced to sell to other countries.
   a. This establishes a dependence upon cash crops by the L.D.C.
   b. The indigenous population is encouraged to depend on imported food.
   c. This concept separates agriculture from nutrition; people lose the ability to feed themselves.
5. The increased investments by multi-national corporations in less developed nations may tend to promote the production of "luxury" crops and perpetuate inequities rather than stimulate the development of rural agriculture.

V. International agricultural technology may only provide short-term relief. (Dr. MacKenzie)

A. The "Green Revolution" is an agricultural technology that involves the genetic development of special strains of wheat, corn, or rice which have greatly increased yields. These high yield variety (HYV) strains require energy-intensive farming in the sense that the use of fertilizers, pesticides, irrigation, and mechanized planting and harvesting are necessary for their success.

B. Dr. Borlog is considered the father of the Green Revolution.
1. He developed "green revolution technology" for wheat production in Mexico.
2. His initial developments were a form of intensive agricultural production of wheat. Peasant farmers could not afford the large-scale mechanized system.

C. Statistically, all gains of the Green Revolution have been consumed by population increases. The net benefit has been only one loaf of bread or two bowls of rice.

D. Agricultural technology can only forestall the Malthusian catastrophe; birth control is the only solution.

F. A few intermediate strides should be made in agricultural technology.
1. Genetic selection for increased yield and for increases in specific nutrients, especially amino acids, is appropriate.
2. Nitrogen fixation would attempt to develop plants that can obtain natural nitrogen, and thereby decrease dependence upon nitrogen fertilizers.
3. Pest control and better grain storage would reduce mass starvation during famine.

VII. The "Lifeboat" and "Triage" concept suggests a defensive posture on the part of developed countries.

A. These theories are based on the belief that most developed nations have an obligation to save themselves and others by being selective as to whom they help.
   1. "Lifeboat" suggests that the populations of the more developed nations are in a lifeboat and other populations are asking to be rescued and brought into the lifeboat. The developed nations cannot take in all who are drowning because the lifeboat will sink if they do so. Therefore, there are selections made as to who will be allowed into the lifeboat.
   2. The Triage theory is based on a medical term that describes the three courses of action used to deal with incoming wounded: 1) those who do not require immediate attention; 2) those who can be saved by immediate action; and 3) those who most likely will die, and time should not be wasted in attempting to save them. Triage, in context of the world food problem, means withholding assistance from the nations whose exponential population growth rates make it impossible to "keep up" with feeding them.

B. Both the "Lifeboat" and "Triage" theories maintain that the U. S. and other developed nations have the power to force the less developed nations to control population.

C. The "Lifeboat" and "Triage" concepts have shortcomings.
   1. The U. S. does not feed the world and, therefore, cannot use the threat of withdrawing food.
   2. Other, more developed nations would step in if the U. S. were to withdraw aid; they might gain a political advantage.
   3. An increased standard of living leads to an increased political awareness. People in less developed nations are not less willing to accept this hollow threat of triage.

There is no study guide assignment for this section.

VITAMINS I

Foreword

Vitamins were among the last nutrients to be discovered. In fact, it was well into the twentieth century before it was realized that something else besides carbohydrates, proteins, fats, water, and minerals were needed to maintain optimal health. That something else was vitamins, thirteen of which are known to be needed by the human body.

Since their discovery, the interest in vitamins has not waned. Vitamins have been responsible for a heightened interest in nutrition. Exaggerations of truths related to vitamins have been used to increase both consumer interest and sales.

This unit provides an overview of vitamins and their functions in the body. Specifically, the functions of the water-soluble vitamins are examined.

Objectives

Upon completion of this lesson which includes text assignments, video viewing, and study guide activities, the participant should be able to:

1. Describe the historical basis for the current belief held by many vitamin enthusiasts that vitamins are a cure-all.
2. Indicate the differences between vitamins and other nutrients.
3. Select true from false vitamin claims.
4. Identify vitamins that cause toxic reactions when taken in megadosages.
5. Name two speculative claims in vitamin C knowledge and research.
6. List the water-soluble vitamins.
7. List the fat-soluble vitamins.
8. Discuss the three effects of solubility on vitamins.
9. Associate the water-soluble vitamins with roles as co-enzymes in cellular reactions.
10. Describe four deficiency characteristics of B-complex vitamins.
11. Discuss the functions of vitamin C.
12. List two effects of consuming vitamin C in megadose levels over a period of time.
13. Distinguish between the anemias caused by vitamin B-12 and folacin deficiency.

Text Assignments

1. Before viewing the video lesson, complete the following reading assignments from Nutrition: Concepts and Controversies by Hamilton, Whitney and Sizer.

Chapter	Topic	Page
9	The Vitamins	220
9	The Fat-Soluble Vitamins	224
9	The Water-Soluble Vitamins	234
9	Controversy 9: Vitamin B-6 Deficiency, How Common Is It?	258

2. Review the terms located in the glossary of Chapter 9, Nutrition: Concepts and Controversies, pages 255-256.

LESSON OUTLINE

I. Vitamins are organic compounds which are essential to life and are required in the diet in small amounts.

  A. Since they are generally not synthesized by the body, vitamins must be supplied to the body through the diet.

  B. The role of vitamins is to regulate body functions.
    1. Vitamins serve as co-enzyme or "enzymes helpers" in the cells.
    2. Enzymes catalyze the reactions that release energy from foods. When the vitamin is missing from the co-enzyme, the enzyme will not function properly.

II. Vitamins are divided into two classes: the fat-soluble vitamins, vitamins A, D, E, and K, and the water-soluble vitamins, vitamin C and B-complex.

  A. Water-soluble vitamins must be supplied in adequate amounts each day. All of the following are water-soluble vitamins.
    1. Thiamin or vitamin B-1,
    2. Riboflavin or vitamin B-2,
    3. Niacin or vitamin B-3,
    4. Pyridoxine or vitamin B-6,
    5. Cobalamin or vitamin B-12,
    6. Biotin,
    7. Pantothenic acid,
    8. Folacin, and
    9. Vitamin C or ascorbic acid.

  B. Fat-soluble vitamins are stored in the body for future use. All of the following are fat-soluble vitamins:
    1. Vitamin A or retinol,
    2. Vitamin D or calciferol,
    3. Vitamin E or tocopherol, and
    4. Vitamin K or phyloquinone.

C. The properties of the two groups of vitamins differ based on their solubility.
   1. The solubility of the vitamin affects its ability to be absorbed from the gastrointestinal tract.
   2. The solubility of the vitamin also affects whether or not the vitamin will be stored in the body.
   3. The solubility of the vitamin affects whether or not there is a potential for toxicity to develop from too large amounts.

III. Because water-soluble vitamins are soluble in water-based mediums, these vitamins readily dissolve in body fluids.

A. There is little storage of these nutrients in the body.

B. Since they are not stored, water-soluble vitamins should be supplied daily in the diet to meet the body's needs; niacin is an exception.

C. Deficiency symptoms develop quickly if these nutrients are not supplied in adequate amounts in the diet.

D. Vitamin C plus a family of vitamins called the B-complex make up the water-soluble class of vitamins.

E. Thiamin, niacin and riboflavin have similar biologic roles.
   1. They are co-enzymes in cellular reactions that cause the release of energy from carbohydrate, protein, and fat.
   2. They are enzyme specific.
   3. The daily requirement for these vitamins is related to the amount of calories consumed.
   4. Thiamin and riboflavin are required daily in the diet; they are not synthesized by the body.
   5. Niacin is formed in the body from the conversion of the amino acid, tryptophan.
   6. When these vitamins are absent from the diet, deficiency symptoms are quick to appear.

F. Pantothenic acid and biotin are co-enzymes that are required for cellular reactions. Deficiencies of these vitamins are rare because they are widespread in foods.

G. Vitamin B-6 or pyridoxine is a co-enzyme in many cellular reactions that involve amino acids. The requirement for vitamin B-6 is closely related to the intake of protein.
   1. Vitamin B-6 assists in the removal and transfer of the nitrogen-containing amino group from amino acids.
      a. The removal and/or transfer of the amino group allows amino acids to be used for purposes other than protein synthesis.
         (1) Nonessential amino acids (NEAA) are synthesized from the transaminated (amino group rearranged) amino acids.
         (2) The deaminated (amino group removed) amino acids can be used as a source of energy for the body. The nitrogen from the amino group is excreted in the urine.

- 2. During periods of rapid growth, such as infancy, childhood, and pregnancy, the requirement for vitamin B-6 increases due to the increase in tissue synthesis and energy requirements.
    - a. An increase in vitamin B-6 requirement also accompanies hormonal changes in the body.
        - (1) When tryptophan is converted to niacin, vitamin B-6 is required as a co-enzyme for the reaction.
        - (2) When more niacin is being formed from tryptophan (as is common in hormonal changes), more vitamin B-6 is required.

H. Two other water-soluble vitamins, vitamin B-12 and folacin, function as co-enzymes. These vitamins function with enzymes in the cells.
- 1. Deficiencies and abnormalities of vitamin B-12 and folacin are evidenced in the red blood cells.
    - a. Deficiencies of both vitamins produce "macrocy" (also called megaloblasts). These are deep red, oversized cells. The cells appear the same regardless of whether the deficiency is in vitamin B-12 or in folacin.
    - b. The presence of these abnormal cells indicates an anemic condition.
- 2. A vitamin B-12 deficiency causes pernicious anemia. This type of anemia damages the myelin sheaths of the nerves.
    - a. Since this vitamin is only found in animal products, persons who eliminate animal products completely from their diets, may experience a deficiency of the vitamin.
    - b. A deficiency of vitamin B-12 is usually caused by poor absorption in the digestive tract.
        - (1) The intrinsic factor, which is synthesized in the stomach, enhances vitamin B-12 absorption.
        - (2) When the intrinsic factor is not present, vitamin B-12 is not absorbed. Instead, it is excreted from the body.
    - c. A severe deficiency of vitamin B-12 results in pernicious anemia.
        - (1) Pernicious anemia causes progressive degenerative damage to nerve tissues.
        - (2) If not reversed, pernicious anemia may eventually cause death.
- 3. Folacin deficiency is usually caused by inadequate dietary intake.
    - a. A major cause of folacin deficiency is the over-reliance upon highly refined foods.
    - b. Folacin deficiency is the most common vitamin deficiency.
    - c. The anemia of folacin deficiency can mask pernicious anemia.

I. Vitamin C is frequently called ascorbic acid.
- 1. Much controversy surrounds the therapeutic use of vitamin C.
    - a. Claims have been made that vitamin C prevents or cures the common cold.
    - b. Research has not proven that vitamin C supplementation is beneficial.

2. Animals can synthesize their own vitamin C.
    a. Vitamin C is closely related to the compound glucose.
    b. Humans are incapable of synthesizing vitamin C; therefore, they require adequate amounts from the diet daily.
3. The major function of vitamin C is the synthesis of collagen, the most abundant protein in the body.
    a. Collagen is found in nearly every tissue.
    b. It is necessary to bind cells together.
    c. Collagen is made from the amino acids proline and lysine. These amino acids must be hydroxylated (OH group added) for collagen to be formed.
    d. If the supply of vitamin C is inadequate, the hydroxylation reaction will not occur, and collagen synthesis will be impaired. As a result, tissues become weaked.
    e. The deficiency of vitamin C is known as scurvey.
        (1) The body's capillary system is affected.
        (2) When collagen can not be synthesized to keep these small blood vessels repaired, they rupture easily and many tiny hemorrhages develop just beneath the skin.
    f. Symptoms of scurvey are relatively slow to develop; they are reversed when vitamin C is re-introduced into the diet.
4. Vitamin C is rarely required as a daily supplement because the vitamin is abundant in foods.
    a. Evidence suggests that megadoses (one gram per day or more) of vitamin C may have harmful effects.
    b. The kidneys are taxed to excrete the unused amounts of the vitamin from the body.
    c. Some individuals may develop transient symptoms of scurvey when they stop taking the supplments.
        (1) This occurs in individuals who have taken the supplement in high doses for a long period of time.
        (2) By consuming the vitamin in such large doses, their requirement is artifically increased; when the supplement is discontinued, the symptoms slowly develop.

Study Guide Assignment

After reading the text assignments and viewing the video lesson, refer to Nutrition: Concepts and Controversies Study Guide and answer questions on the following pages. If there is difficulty answering the questions, refer to the appropriate chapter of the text. Upon completion of the study guide questions, check the answers with the correct answers in the study guide.

Chapter	Title	Page
9	The Vitamins	144
9	Definition and Classification of Vitamins	144
9	The Water Soluble Vitamins	147
9	Thiamin	147
9	Riboflavin	147
9	Niacin	148
9	Vitamin B-6	148

9	Folacin	148
9	Vitamin B-12	149
9	Other B Vitamins	149
9	Non B Vitamins	149
9	Vitamin C	149
9	Food Feature: Cooking to Preserve Vitamins	150
9	Vitamin B-6 Deficiency: How Common Is It?	150

Self Test

After completing all assignments and activities related to this lesson, take the self-test found on pages 152-155 and 159 of Nutrition: Concepts and Controversies Study Guide. Check the answers in the self-test answers section, and review questions that were missed.

VITAMINS II

Foreword

The second lesson on vitamins examines fat-soluble vitamins. Included in this unit are the vitamin sources, functions, and deficiency symptoms. In addition, more complex issues regarding vitamin supplementation and possible toxicities will be discussed. Topics to be addressed are methods utilized in determining vitamin needs, origin and validity of vitamin claims, and the appropriate use of vitamin supplements.

Objectives

Upon completion of the second lesson on vitamins, which includes text assignment, class presentations, and study guide activities, the participant should be able to:

1. Recall the names of the vitamins that are classified as fat-soluble.
2. Name the two fat-soluble vitamins which are known to be toxic when ingested in excessive amounts.
3. Identify the major physiological function for each of the fat-soluble vitamins.
4. Specify the major deficiency symptoms of the fat-soluble vitamins.
5. Associate vitamin deficiency symptoms with vitamin functions in the body.
6. Describe the role of vitamin A in the synthesis of rhodopsin in the visual cycle.
7. Name the vitamin A precursor found in plants.
8. Identify vitamin D as the fat-soluble vitamin which can be synthesized from a precursor molecule found in the body.
9. Discuss the significance of vitamin D fortification in milk.
10. Explain the general procedures for determining the amounts of specific vitamins required to prevent deficiencies among humans.
11. Distinguish between single-blind studies and double-blind studies with respect to their appropriateness for validating vitamin claims.
12. Identify the specific instances in which vitamin deficiencies _may_ occur.
13. Describe how reliance upon highly processed foods influences the ability to obtain adequate amounts of vitamins from the diet.

Text Assignment

Before viewing the video lesson, complete the following reading assignment from Nutrition: Concepts and Controversies by Hamilton, Whitney and Sizer.

Chapter	Topic	Page
9	Fat-Soluble Vitamins	224
9	Vitamin A	224
9	Vitamin D	229
9	Vitamin E	231
9	Vitamin K	233
2	Vitamin, Mineral, and Other Supplements	33
9	Glossary	255

Lesson Outline

I. Fat-soluble vitamins have characteristics that are based on their solubility.

A. Fat-soluble vitamins do not dissolve in water or body fluids.

B. Excesses of these vitamins are stored in the body. The amount stored varies based on the particular vitamin.

C. If storage is excessive, a toxicity may develop.

D. A rich daily source of these vitamins is not essential since the normal surplus can be called from storage.

II. Vitamin A was previously called "visual A" because of its function in normal vision.

A. The most clearly understood function of vitamin A is its role in vision in dim light.
1. Upon entering a dark room, the eyes must adjust to the darkness or to night vision.
2. Night blindness is the loss of night vision or vision in dim lights. This is one of the earliest clinical signs of a vitamin A deficiency.
3. Individuals with night blindness cannot adjust to dim light because they cannot synthesize a light-sensitive pigment called rhodopsin; this is due to a deficiency of vitamin A.
4. Rhodopsin normally controls the visual adaptation to night vision.
    a. Vitamin A combines with a protein, opsin, in the rods of the eyes to form rhodopsin.
    b. When light strikes the eye, rhodopsin is broken down to form opsin and a derivative of vitamin A. This is a continuous cycle, and in order to re-combine with opsin, more vitamin A is required.
5. It is the effect of rhodopsin on the rods that allows the eyes to adapt to vision at night.

B. Other functions of vitamin A are not as clearly understood.
   1. Vitamin A is needed for growth; in a deficiency, growth is retarded.
   2. Vitamin A is also required for reproduction.
   3. Vitamin A is required for the development and maintenance of epithelial cells.
      a. Epithelial tissue is formed on the outer surface of the skin and lining of the digestive tract and lungs.
      b. Epithelial tissues are an important line of defense for the body; they prevent the invasion of microorganisms or other contaminants that should be kept out of the body.

C. Requirements for vitamin A are influenced by several factors.
   1. The efficiency of vitamin absorption affects the amount of the vitamin that will be used in the body.
   2. The presence of rapid body growth influences the need for the vitamin.
   3. The actual food source from which the vitamin or its precursor is obtained influences the requirement.
      a. Preformed vitamin A is an active form of the vitamin. It is found in animal products such as liver, organ and muscle meats, and milk.
      b. Vitamin A precursors, the carotenes, are found in plants. Beta-carotene is the most active precursor of vitamin A.

D. Vitamin A deficiency symptoms occur because the vitamin is not present in sufficient quantities to maintain its normal function.
   1. An early symptom of a deficiency is night blindness. If the deficiency is not corrected, total blindness can result.
   2. Growth is retarded in children.
   3. Epithelial tissues become keratinized. The tissues become very dry. The cells become irregular in shape, flattened, and lose their cilia.
      a. Old cells are not sloughed off but begin to build up and form crusty patches.
      b. When this happens, the tissue progressively loses it protective function; tissues become more susceptible to infection and to the development of pustules. (Since the pustules resemble acne, it has been suggested that a deficiency of vitamin A causes acne, but no substantial evidence exists to support this theory.)

III. Vitamin D, sometimes called the "sunshine vitamin," can be synthesized by the body.

A. A precursor molecule under the skin can be converted to the active form of the vitamin after exposure to ultra-violet light.
   1. Several factors limit exposure to ultra-violet light.
      a. There is less ultra-violet light in the tropical zone than in the temperate zone.
      b. Smog, fog, clouds, and clothing limit exposure to ultra-violet light.
   2. The two major sources of vitamin D are ergocalciferol (vitamin D-2) which is of plant origin, and cholecalciferol (vitamin D-3) which is of animal origin.

B. Vitamin D is not naturally abundant in foods of either plant or animal origin, but some foods, such as milk, are fortified to provide a rich dietary source of this nutrient.

C. Vitamin D's major functions are associated with calcium in the body.
  1. Vitamin D regulates calcium absorption from the intestines.
  2. It plays a role in the regulation of calcium utilization in hard tissues such as bones and teeth.
  3. It works with hormones to maintain blood calcium levels. If these levels are not maintained, tetany (involuntary muscle spams) will result.

D. Vitamin D requirements are difficult to assess because of the internal synthesis of the nutrient by exposure to sunlight.
  1. Needs are higher during rapid periods of growth, pregnancy, lactation, and bone healing.
  2. The RDA was established to cover these periods of rapid tissue development. The RDA is 400 I.U. per day (10 micrograms) which is the amount of vitamin D added to one quart of milk.

E. Vitamin D deficiency symptoms are those of inadequate calcification of bone.
  1. In children, rickets can develop.
    a. The bones do not harden because calcium is not deposited normally.
    b. Bones remain pliable and bend with the weight of the body. Bowed legs result.
  2. Adults may experience a similar condition called osteomalacia.
    a. The bones lose minerals and become weak and brittle.
    b. Osteomalacia is caused by poor absorption of calcium (caused by a lack of vitamin D or an inability to convert vitamin D to its active form).

IV. Vitamins A and D can be toxic if consumed in excess amounts.

A. A serious consequence of vitamin D toxicity is the deposition of calcium abnormally in soft tissues, such as kidney, muscles, or blood vessels. The calcium deposits damage these tissues and diminish their normal function.

B. Vitamin A toxicity symptoms are evidenced by skin and hair changes, abdominal pain, and pressure on the brain.

C. Toxicity symptoms may develop rapidly if there is an extremely high intake of the vitamin or if there is a limited storage capacity.

D. Supplements containing vitamins A and D should be used cautiously.

V. Vitamin E is the vitamin which is often claimed to be a "cure-all" substance, yet, there are many unanswered questions about the role of vitamin E.

A. Vitamin E is a group of compounds called tocopherols; the most active tocopherol is alpha-tocopherol.

B. The major function of vitamin E is to protect polyunsaturated fatty acids in plant oils from damage caused by oxidation.
   1. Vitamin E prevents oxygen, which would cause rancidity, from combining with these fatty acids.
   2. Vitamin E takes oxygen into its own structure and becomes oxidized itself, thus protecting the fatty acids. (Some researchers suggest that vitamin E plays a similar protective role in human tissues).

C. Symptoms of vitamin E deficiency in humans are rare, yet, many claims to the contrary exists.
   1. Most claims are related to deficiencies seen in laboratory animals, not humans.
   2. In humans, the only known deficiency symptom is hemolytic anemia, a blood abnormality which occurs in premature infants who have minimal vitamin E stores.
      a. The red blood cells are fragile and have a shorter life span than normal.
      b. Provision of vitamin E reverses the symptoms of hemolytic anemia.

D. It has been difficult to establish a recommended allowance for vitamin E because deficiencies are rare, and the vitamin's function in the body is unclear.

E. The need for vitamin E is increased by a high intake of polyunsaturated fatty acids; however, most sources of polyunsaturates are, themselves, high in vitamin E.

F. At the present time, vitamin E, in excessive dosages, is not believed to be toxic.
   1. Vitamin E storage is not concentrated in one organ. Instead, it is distributed throughout the body. Because of this, the threat of toxicity is reduced.
   2. Some excess of vitamin E can be excreted through feces. Yet, it is important to recognize that vitamin E is a fat-soluble vitamin, and a potential for storage of large doses from supplements can exist.

XI. Vitamin K is involved in blood coagulation.

A. Vitamin K assists in normal blood clotting.
   1. This vitamin is required for the synthesis of prothrombin by the liver.
   2. Prothrombin is required to initiate a series of reactions leading to the formation of fibrin. Fibrin forms the actual blood clot.
      a. Fibrin acts as a network to trap red blood cells at the site of an injury.
      b. If vitamin K is not available, a fibrin clot is not formed and blood loss can be very serious.

B. Presently there is no recommended dietary allowance for vitamin K.

C. Deficiencies of vitamin K are rare because the vitamin is widely available in foods, and it can be synthesized by bacteria in the intestinal tract.

D. Newborn infants lack the intestinal bacteria to synthesize the vitamin because their gastrointestinal tracts are sterile.
   1. At birth, infants have low body stores of the vitamin, and milk, their dietary staple, contains very little vitamin K.
   2. Because they are susceptible to vitamin K deficiency and subsequent hemorrhaging, infants are generally given a vitamin K supplement at birth.

VII. How much of the vitamins are really needed?

A. Vitamin requirements are determined by establishing the minimum amount of a vitamin that will prevent an individual from developing deficiency symptoms.
   1. This is done by systematically decreasing the amount of the vitamin until deficiency symptoms appear.
   2. The vitamin is then re-introduced until the symptoms subside. The amount required to avoid vitamin deficiency symptoms is established as the minimum requirement.
   3. The RDA is set much higher than the minimum allowance to allow for a margin of safety.

B. Many claims exist which state that it may be desirable to have intakes of some vitamins at levels considerably above the RDA.
   1. Many claims are based on anecdotes of observations not obtained in a scientifically controlled manner.
   2. Claims should be evaluated by scientific research studies.
      a. Scientific research studies may be single-blind or double-blind in design. Both designs involve the use of a control group and an experimental group.
         (1) In the single-blind design, a test substance is given to the experimental group and a placebo is given to the control group.
         (2) The subjects do not know to which group they belong, but the researcher knows which group is receiving the test substance and which group is receiving the placebo; thus, observations may be subject to the researcher's bias.
         (3) In the double-blind design, neither the subjects, nor the researcher have knowledge of the group composition; therefore, this type of study has the least amount of bias.
      b. Results from double-blind studys are the most reliable.

VIII. Many questions should be posed when evaluating a vitamin claim.

A. Who is making the claim?

B. What are their credentials?

C. What is the evidence that the claim is accurate?

D. What kind of research was done to gather the evidence?

E. Did the study use human or animal subjects?

F. Does the claim bear some relationship to what is known about the vitamin function?

IX. Despite the fact that vitamins are widely available in foods and are needed in small quantities, deficiencies may occur under some conditions.

   A. The diet may lack a particular vitamin or its precursor.

   B. The body may be unable to absorb a vitamin or vitamins. This may result in multiple deficiencies.

   C. Needs may be increased physiologically, especially during periods of growth or stress.

   D. A vitamin antagonist may interfere with vitamin functions.

X. Many recommendations concerning the use of vitamin supplements have been made.

   A. Do not take large doses of vitamins.

   B. Evaluate vitamin claims before taking supplements.

   C. Select foods from a wide variety of sources. If this is practiced, vitamin supplements are generally not needed.

   D. Be suspicious of vitamin advertisements recommending supplements to compensate for poor eating habits.

Study Guide Assignment

After reading the text assignments and viewing the lesson, refer to Nutrition: Concepts and Controversies Study Guide and answer questions on the following pages. If there is difficulty answering the questions, refer to the appropriate chapter of the text. Upon completion of the study guide questions, check the answers with the correct answers in the study guide.

Chapter	Title	Page
9	The Fat-Soluble Vitamins	144
9	Vitamin A	145
9	Vitamin D	146
9	Vitamin E	146
9	Vitamin K	147
2	Vitamin, Mineral and Other Supplements	33

Self-Test

After completing all assignments and activities related to this lesson, take the self-test found on pages 36 and 155-158 of Nutrition: Concepts and Controversies Study Guide. Check the answers in the self-test answer section, and review questions that were missed.

MINERALS

Foreword

Minerals as a class of nutrients have many significant functions. While only 4% of the body weight is composed of minerals, their roles, as structural components and metabolic regulators, are absolutely vital to the body's normal operation. This lesson reviews the requirements for minerals, their major functions, food sources, and the controversies that surround mineral supplementation.

Objectives

Upon completion of this unit which includes a text assignment, class presentations, and study guide assignments, the participant should be able to:

1. Distinguish between inorganic and organic sources of elements required for plant growth.
2. List three factors which influence the quantity of nutrients present in plants.
3. Discuss the consequences of having soil that is deficient in one or more of the elements needed by plants for optimal growth.
4. Identify three factors which determine the nutritional consequences of relying on plants grown in soil depleted of a particular element.
5. List the advantages and disadvantages of both inorganic and organic forms of fertilizer.
6. Compare the relative quantity of minerals required with the quantity of energy-yielding nutrients required by humans.
7. Distinguish between macrominerals and microminerals.
8. State two reasons why certain minerals may be deficient in some diets.
9. Associate the normal blood levels of minerals with the levels that produce deficiencies and toxicities.
10. Name the two main functions of minerals in the body.
11. Identify the roles of calcium, phosphorus, and fluorine in hard tissues.
12. Associate the role of iodine with the prevention of goiter.
13. Distinguish between minerals as enzyme components and minerals as enzyme co-factors.

14. Identify phosphorus as the mineral component of adenosine triphosphate (ATP), the molecule in which energy released from food is captured.

15. Associate iron's attraction for oxygen with its function in hemoglobin.

16. Name the two storage forms of iron.

17. Describe iron deficiency anemia in terms of the symptoms which appear in the blood.

18. Recognize that minerals play an important role in maintaining the sensitive balance between acids and bases in the body.

19. List the minerals which produce acidic conditions and those which produce alkaline conditions.

20. Recognize that organic acids in foods do not produce acids in the body.

21. Describe the fluid compartments within the body.

22. Recognize that mineral concentrations on either side of a membrane influence the flow of fluids through that membrane.

23. Name the two minerals which most affect the production of nerve impulses.

24. Associate calcium with muscle contractions.

Text Assignment

Before viewing the video lesson, complete the following reading assignment from Nutrition: Concepts and Controversies by Hamilton, Whitney and Sizer.

Chapter	Topic	Page
10	Minerals and Water	265
10	Controversy 10: Nutrition and Premenstrual Syndrome	306
10	Glossary	302

Lesson Outline

I. The mineral elements are relied upon as the fundamental constituents of all forms of life.

   A. Green plants and some microorganisms are able to extract compounds and transform them into substances that are needed by higher forms of life.
      1. Green plants utilize elements for their growth and for synthesis of new compounds.
         a. Carbon dioxide and water are extracted from the atmosphere.
         b. Sunlight is used to provide energy that rearranges the carbon, hydrogen, and oxygen atoms to make more complex compounds from carbon dioxide and water.
      2. Plants are also able to extract many elements from the soil, particularly nitrogen, phosphorus, and potassium. Plants use these elements as a nutrient source.

   3. Only if the elements and sunlight are present, will plants synthesize carbohydrates, proteins, lipids, and vitamins needed for life.

B. Plants depend on their roots to extract elements from the soil.
   1. These elements are absorbed from the soil as single atoms or as small molecules of only a few atoms.
      a. This is the simplest form of the element and is called the inorganic form.
      b. The inorganic form is found in chemical fertilizers.
   2. Elements are also present in organic form. Examples include composts and decaying materials.
   3. Elements are absorbed by plants only in the inorganic form.
      a. Plant requirements for elements can be supplied by both organic and inorganic sources.
      b. If the organic form of an element is present, the element must first be converted to the inorganic form.

C. Plants will synthesize carbohydrates, proteins, fats, and vitamins from the elements in the soil if there is adequate water and sunshine.

D. Several factors influence the quantity of carbohydrates, proteins, lipids, and vitamins synthesized in the plant.
   1. The genetic make-up of the plant affects the quantity of nutrients.
   2. Nutrient content is influenced by the season in which the plant is grown.
   3. The maturity of the plant will also influence its nutrient content.

E. Plants grown in soil that is deficient in one or more nutrient elements that are essential for plant growth will contain lower amounts of the deficient element.
   1. In these plants, quantities of carbohydrates, proteins, lipids, and vitamins will be near normal.
      a. The plants will, however, be smaller in size.
      b. The yield of the plant will be reduced.
   2. If the plant yield is reduced, there will be less of the product available for consumption by humans.
      a. In some areas of the world, a serious consequence of reduced plant yield is famine.
      b. Other consequences of reduced yield depend upon the degree to which the element (and subsequently the plant) is required by humans.

F. Both organic and inorganic fertilizers can be used in crop production.
   1. The elements in organic fertilizers exist in a complex form as a part of carbon compounds. In order to be utilized by the plant, the elements must be broken down from the carbon compounds.
   2. Inorganic fertilizers contain elements in a form that are readily absorbed by plant roots.
   3. The most important factor to be considered in the comparison of fertilizers is whether or not they contain the elements in proportions needed by the plant.

II. Minerals account for only a small amount of the food consumed, and they are required in minute quantities. Essential minerals must be supplied in the diet.

A. Minerals are categorized based on their presence in body tissues.
   1. Macrominerals are present in the body in amounts greater than 0.005% of the body weight. An example is calcium.
   2. Microminerals are present in the body in amounts less than 0.005% of the body weight. An example is iron.

B. Minerals of most concern in human nutrition are those which are considered to be "at risk" or in danger of being deficient in the diet.
   1. Minerals that are "at risk" are so because there is a high requirement for the mineral in comparison to the number of foods that are a rich source. An example is calcium.
   2. Minerals may also be "at risk" if there is a low requirement, but limited food sources. An example is iron.

C. Most diets are abundant in sodium and phosphorus; there is more concern about excesses in these mineral elements than deficiencies.

D. The physiological limits are the upper and lower levels of the mineral in the body. In order for the mineral element to assume its normal function in the body, it must be supplied at its optimal level.

III. Minerals are components of hard tissues and certain biological compounds.

A. The hard tissues in the body are bones and teeth. These tissues contain large amounts of the body's mineral stores.
   1. Crystals of calcium and phosphorus are deposited into a protein matrix to provide strength for bones and teeth.
   2. Calcium requirements increase during periods of rapid growth.
      a. The increased need for calcium is due to the high proportion of calcium-phosphorus crystals being deposited into the matrix.
      b. Adults continue to require relatively large amounts of calcium for bone tissue turn-over or remodeling.
   3. Fluorine is incorporated into some calcium-phosphorus crystals.
      a. Flourine is a component of the crystals that form tooth enamel.
      b. Tooth enamel that contains deposits of fluorine in the calcium-phosphorus matrix is less soluble in acids formed in the mouth; thus, the teeth are more resistant to decay.

B. Biological compounds contain a small amount of the body's mineral composition.
   1. Hormones are biological compounds that regulate a number of body functions.
      a. Iodine is a component of thyroxine, which is secreted by the thyroid gland.
         (1) Thyroxin regulates the rate of cellular metabolism.
         (2) Goiter (an enlargement of the thyroid gland) occurs due to a deficiency of iodine. The gland is overstimulated to secrete thyroxin, and it enlarges.
         (3) Rich dietary sources of iodine are seafoods. The incidence of goiter is higher where the soil is low in iodine and the food supply is mainly from that area.
         (4) The use of iodized salt has dramatically reduced the incidence of goiter.

2. Minerals play an important role in the structure of enzymes. Enzymes are biological catalysts.
    a. Minerals function to hold the protein chains of enzymes in a specific shape, thus enabling them to function properly.
    b. Examples of minerals that function in enzymes are zinc, iron, and copper.
3. Adenosine triphosphate (ATP) is a high energy compound that relies on a mineral for its formation.
    a. ATP contains three phosphorus-containing groups.
    b. The energy bonds contained in ATP hold a high amount of energy.
    c. Glucose, fatty acids, and amino acids are sources of the energy used to form ATP.
    d. Energy from ATP is the direct source of energy for body processes.
4. Hemoglobin is the red pigment in red blood cells. Hemoglobin relies on the mineral, iron, for its formation.
    a. Four atoms of iron are present in the hemoglobin molecule.
    b. There are two parts of the hemoglobin molecule, globin (protein chains) and heme, which contains iron.
    c. Iron has a great attraction for oxygen; it readily unites with iron in order to be transported in the body.
        (1) This characteristic of iron gives hemoglobin the ability to pick up oxygen from the lungs and carry it to the cells.
        (2) Each molecule of hemoglobin can carry four molecules of oxygen.
5. Iron utilization in the body is influenced by several factors.
    a. The storage forms of iron are ferritin and hemosiderin.
        (1) Hemosiderin is stored only when there is an adequate supply of ferritin.
        (2) Iron is stored in the liver, spleen, and bone marrow.
    b. When there is a need for iron to synthesize body compounds, iron is transported from storage in the form of transferrin.
    c. If there is a low intake of iron in the diet for a long period of time and the storage levels are reduced, iron deficiency anemia results.
        (1) Hemoglobin synthesis in red blood cells is reduced.
        (2) The oxygen carrying capacity of hemoglobin is reduced.

IV. Minerals are initiators and regulators of body processes.

A. Certain minerals are involved as co-factors in enzymes.
1. As co-factors, minerals are not a part of the enzyme structure itself.
2. Examples of mineral co-factors are calcium and magnesium. Magnesium functions as a co-factor in the breakdown and formation of ATP.

B. Another major regulatory role of minerals is their function in the maintenance of the body's acid-base balance.

1. An index of acidity or alkalinity is the pH scale, which is a numerical scale from 1-14.
   a. A pH value below 7 is acidic. The closer the pH value to 1, the more acidic. A pH value above 7 is alkaline. The closer the pH value to 14, the more alkaline.
   b. A pH value of 7 is neutral.
2. A mineral compound is the combination of two or more mineral elements.
3. Minerals also exist in the body as positively or negatively charged atoms called ions.
   a. Some mineral ions, when combined with other substances, form acids in the body. Examples of acid-forming ions are chlorine, sulfur, and phosphorus.
   b. Some mineral elements form bases when combined with other substances. Base-forming ions include calcium, potassium, and sodium.
4. By regulating the concentration of mineral ions in the body, a constant acid-base balance is maintained. The kidneys and lungs also play an important role in the maintenance of this delicate balance.
5. Organic acids such as acetic and citric acids give foods an acidic taste; since they are broken down to carbon dioxide and water, they do not affect the pH of the body.

C. Minerals function in the distribution of water within fluid compartments of the body.
   1. Approximately 60% of the weight of the body is water weight.
      a. Fluid compartments exist in the body.
         (1) The intracellular fluid is the water within the cells.
         (2) Extracellular fluid exists outside the cells; this fluid includes both intravascular (within blood vessels) and interstitial (between cells and tissues) compartments.
      b. Fluid balance is maintained through these compartments.
   2. The body tissues and fluids must be maintained at a certain pH in order for the body to carry out its metabolic activities.
      a. The range of pH within body fluids is very narrow, from 7.2-7.4.
      b. The body uses a number of different mechanisms to maintain this narrow pH range. Minerals have an important function in all of these mechanisms.
   3. Mineral concentrations on either side of a membrane are responsible for the regulation of fluid levels within fluid compartments.

D. Minerals assist in the activities of muscles and nerves.
   1. Muscle movement involves nerve impulses and muscle contractions.
   2. Sodium and potassium play important roles in the initiation and transmission of nerve impulses.
   3. Calcium plays an important role in muscle contractions.
   4. If there is a disturbance in the balance of these minerals, tetany (spasmodic and uncontrolled muscle contractions) results.

Study Guide Assignment

After reading the text assignments and viewing the video lesson, refer to Nutrition: Concepts and Controversies Study Guide and answer questions on the following pages. If there is difficulty answering the questions, refer to the appropriate chapter of the text. Upon completion of the study guide questions, check the answers with the correct answers in the study guide.

Chapter	Title	Page
10	Introductory Questions	169
10	Water	169
10	The Water Supply	169
10	Toxic Metals in the Water Supply	169
10	Organic Compounds in the Water Supply	169
10	Diffusion and Osmotic Pressure	170
10	The Major Minerals: Calcium	170
10	Adult Bone Loss	172
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10	Sodium, Other Minerals and High Blood Pressure	172
10	Food Feature: Meeting Calcium Needs	173
10	Food Feature: Controlling Sodium	173
10	Chloride	173
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10	Nutrition and Premenstrual Syndrome	175

Self-Test

After completing all assignments and activities for this lesson, take the self-test found on pages 178-183 of Nutrition: Concepts and Controversies Study Guide. Check the answers in the self-test answers section, and review questions that were missed.

OBESITY AND DIETING

Foreword

Obesity and overweight are the major health and nutrition related problems in America today. People who weigh at least 10% more than they should make up about one-third of the population in the United States. In addition, overweight is becoming a preoccupation for many, and millions of dollars are spent each year on weight-loss gimmicks.

In spite of all this attention, obesity is one of the most poorly understood problems in nutrition. Its causes, its effects on health, and the approaches to correct it are explored in this lesson.

Objectives

Upon completion of this unit which includes a text assignment, class presentations, and a study guide assignment, the participant should be able to:

1. Define positive energy balance and negative energy balance in terms of their relative impact on weight status.
2. Identify the three uses of calories by the body.
3. Describe two theories of appetite control.
4. Recognize the risk of lifelong obesity.
5. Identify two traits that are generally characteristic of fad weight loss diets.
6. Describe two types of claims that surround fad weight loss diets.
7. List characteristics of a sensible weight reduction program.

Text Assignment

Before viewing the video lesson, complete the following reading assignments from Nutrition: Concepts and Controversies by Hamilton, Whitney, and Sizer.

Chapter	Topic	Page
7	Energy Balance: Feasting, Fasting Loafing, Exercising	159
8	Energy Balance: Overweight and Underweight	187
8	Controversy 8: Bulimia and Anorexia Nervosa	215

I. Obesity is defined as 20% above ideal body weight.

- A. Seventy-nine million Americans are overweight.
- B. Many health problems occur with greater frequency in obese people.

II. Americans are preoccupied with obesity.

- A. One million dollars are spent per hour on weight-loss approaches in America.
  1. Money is spent for fad diet books and dietetic foods.
  2. Due to the popularity of exercise programs, memberships in health spas are increasing.
- B. While this preoccupation persists, the above approaches seldom resolve the problem of obesity.

III. Obesity is a problem of energy balance or excess caloric consumption.

- A. Energy balance is the relationship between the number of calories consumed and the number of calories used for energy.
  1. A positive energy balance exists when more calories are taken into the body than are expended; weight gain is the result.
  2. A negative energy balance exists when more calories are used than consumed; weight loss is the result.
- B. When caloric consumption is equal to energy expenditure, weight maintenance results.

IV. Food energy is measured in calories.

- A. Calories are required for basal metabolism.
  1. Basal metabolism includes the energy required for respiration, circulation, and maintenance of muscle tone and body temperature. All body tissues require energy.
  2. Basal metabolic needs are influenced by body size and composition, physical condition, sex, and thyroid gland activity.
- B. Physical activity requires energy. This factor can be altered to change energy output.
- C. A small amount of energy is required to digest food.

V. Two theories suggest that appetite controls eating habits.

- A. The external cues theory maintains that outside or environmental factors stimulate appetite.
- B. The internal factors theory suggests that fat cell numbers are linked to the degree of appetite.

VI. Weight maintenance can be achieved by following a sensible diet.

- A. An ideal diet for weight reduction should be nutritionally balanced.
  - 1. Calories should be reduced to the extent that the body becomes reliant on its caloric reserves.
  - 2. The diet should provide sufficient amounts of vitamins and minerals.

- B. Variety in the weight reduction regimen will assure good nutrition.

- C. Fad diets appeal to many as a means of losing weight quickly and painlessly.
  - 1. Fad diets generally restrict food choices.
  - 2. They commonly emphasize one or more "miracle" foods.
  - 3. Ninety-five percent of the people who lose weight on a fad diet gain it back almost immediately.

- D. Numerous quick weight loss diets exist.
  - 1. These diets are usually based on incorrect information regarding metabolism.
  - 2. The hazards of such diets include ketosis, dehydration, nausea, dizziness, fatigue, and if the diet continues for an extended period, organ failure may ensue.

- E. Generally, weight reduction diets are not recommended for children and teens.
  - 1. Adequate caloric intake is vital to their continued growth and development.
  - 2. With children and teens, it is more desirable to prevent weight gain by controlling eating habits and encouraging exercise.

- F. A sensible approach to weight control includes a balanced diet, exercise, and behavior modification.
  - 1. The reducing diet should include fewer calories, but never less than 1,200 per day.
    - a. The diet should be adequate in vitamins and minerals and should include a balance of all three energy nutrients, carbohydrates, proteins, and fats.
    - b. The diet should be tailored to meet individual food preferences, contain a satisfying amount of food, and be reasonable in cost.
    - c. It should also be adaptable to meals at home and in restaurants and, above all, be easy to follow.
  - 2. Weight loss programs that incorporate exercise with diet are more effective than diet alone.
    - a. Exercise increases muscle mass and reduces fat stores.
    - b. Exercise increases basal metabolic rate while increasing energy level.
    - c. Exercise supresses appetite and reduces anxiety.
  - 3. Changes in behaviors and attitudes toward food result in more successful long-term weight management.
    - a. The primary goal of behavior modification is to establish healthy eating habits.
    - b. If successful dieters do not retrain themselves, they will return to former eating habits, and weight gain will occur.

Study Guide Assignment

After reading the text assignments and viewing the lesson, refer to Nutrition: Concepts and Controversies Study Guide and answer questions on the following pages. If there is difficulty answering the questions, refer to the appropriate chapter of the text. Upon completion of the study guide questions, check the answers with the correct answers in the study guide.

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7	Starting Point	110
7	Feasting	110
7	Fasting	110
7	Moderate Weight Loss	111
7	Food Feature: Counting Calories	111
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8	Incidence and Onset of Obesity	128
8	Hazards of Obesity	129
8	Causes of Obesity	129
8	The Successful Treatment of Obesity	130
8	Food Feature: Planning a Weight-Loss Diet	130
8	The Problems of Underweight	130
8	Bulimia and Anorexia Nervosa	131

Self-Test

After completing all assignments and activities related to this lesson, take the self-test found on pages 115-118 and 133-136 of Nutrition: Concepts and Controversies Study Guide. Check the answers in the self-test answers section, and review questions that were missed.

The Nutrition Education and Training Program of the Division of Child Nutrition, North Carolina Department of Public Instruction is available to all individuals regardless of race, color, national origin, sex, age, religion or handicap. Persons who believe they have been denied equal opportunity for participation may write to the Secretary of Agriculture, Washington, D.C. 20250.

Introductory Principles of Nutrition

Instructor's Manual

DIVISION OF CHILD NUTRITION
NORTH CAROLINA DEPARTMENT OF PUBLIC INSTRUCTION

SP 030 001

INTRODUCTORY PRINCIPLES OF NUTRITION

INSTRUCTOR'S MANUAL

DIVISION OF CHILD NUTRITION

NUTRITION EDUCATION AND TRAINING PROGRAM
Division of Child Nutrition
Department of Public Instruction
Raleigh, NC
1987

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This project was funded by the Division of Child Nutrition, North Carolina Department of Public Instruction, under the Nutrition Education and Training Program.

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FOREWORD

The North Carolina Department of Public Instruction, Division of Child Nutrition, receives funds under Public Law 95-166 to conduct the Nutrition Education and Training (NET) Program in school systems throughout the state. The overall goals of the Division of Child Nutrition are to promote nutrition education and to safeguard the health and well-being of the children of North Carolina. To help achieve these goals, an instructor's manual has been developed to accompany the Introductory Principles of Nutrition series.

Teachers of the basic core subjects, including health, mathematics, science, social studies, language arts, and other subjects, such as physical education and home economics, have the responsibility of helping students learn the basic principles of nutrition. This will enable them to become wise food consumers and understand the important relationship between nutrition and health. The instructor's manual to accompany "Introductory Principles of Nutrition" is designed to assist the course facilitator in structuring the training sessions. Suggestions for maximizing the effectiveness of each videotaped session are included.

This course was developed to provide teachers and curriculum specialists with special training in nutrition and to strengthen their skills in teaching basic nutrition concepts to students. It provides an update on the developments and advances in the field of nutrition, thus allowing teachers to provide students with the most current information.

A Craig Phillips

A. Craig Phillips
State Superintendent of Public Instruction

Theodore R. Drain
Assistant State Superintendent, Support Services

INTRODUCTION

This course is an introductory level nutrition course for educators responsible for incorporating nutrition education into the curriculum of the North Carolina public schools. The course presentation combines several teaching techniques including text assignments, videotapes, instructor-guided discussions and activities, and study guide assignments. It is hoped that this multi-faceted approach will provide for optimal learning outcomes.

This course combines factual nutrition information with issues on controversies that surround the topics. The factual information must first be mastered; then, the controversies can be explored. Television has been chosen as the medium for delivering this course for two reasons. First, it is one way to bring a college professor to any school system choosing to sponsor the course; and second, the videotaped presentations use elaborate visuals that may not be available to all instructors.

The videotaped series to be used in the course is entitled Introductory Principles of Nutrition. This series of films was developed by Pennsylvania State University, College of Human Development, Nutrition Department, for televised instruction. The text to accompany the series is Nutrition: Concepts and Controversies by Eva May Hamilton, Eleanor Whitney, and Frances Sizer. The study guide to accompany Nutrition: Concepts and Controversies, written by Agnes Hartwell and Sharon Rolfes, will be used to reinforce information presented in the text. The Instructor's Manual and Course Outline provide learning activities which combine information from the videotaped presentations and text material. The outline should be used in conjunction with the THIRD EDITION of Nutrition: Concepts and Controversies.

Participants may come to the class with some reservations about televised instruction. It may be beneficial to explain the reasons for this type of presentation. With the supporting material provided, the instructor should be able to develop a meaningful nutrition course for the participant.

The videotapes provide factual information. The instructor has the freedom to use the discussion period after each tape to share supplementary information with participants, clarify or expand on concepts, and conduct activities or discussions to reinforce the information presented in the video lesson.

Participants should be instructed to read text assignments and lesson objectives prior to viewing each videotape. The assignments and objectives are listed in the Course Outline. During the viewing sessions, participants may follow the lesson outline provided in the Course Outline. The outlines are quite detailed, thus enabling participants to make minimal notations and focus on the concepts presented.

The study guide for each lesson should be completed by the participant after viewing each videotape. The study guide is designed to be a learning aid and not a test instrument. For this reason, participants should be encouraged to refer to the text or lesson outline when necessary. Self-tests follow the study guide activities. These tests are designed to give participants a means of evaluating their comprehension of the concepts that have been presented. The self-test, therefore, should be completed without referring to the test or lesson outline.

Instructors should become familiar with the format of the Instructor's Manual before preparing lesson plans. Each chapter of the manual represents a video lesson and corresponds to the materials in the Course Outline which will be used by the participants.

The following information is contained in each chapter of the Instructor's Manual:

General Instructions

This section of the manual includes basic topics presented in the videotape. Special instructions for combining the videotaped information with the text assignments are provided. In addition, special concepts that should be emphasized in class discussions are included, as well as suggested activities.

Participant Objectives

The learning objectives for each lesson are included in this section. These are the same objectives that appear in the Course Outline. These will be useful in developing class activities, guiding class discussions, and facilitating participant evaluations.

Instructor's Information

Contained in this section is a lesson overview and suggested application strategies. Some lessons contain additional activity suggestions that may not be included in the textbook or videotape.

Guidance From Instructor's Resource Manual

In this section, material from the Instructor's Resource Manual - Nutrition: Concepts and Controversies, third edition, is provided to the instructor in order to effectively incorporate new material into the lesson plans. Included are an overview, lecture outline, key terms, transparencies, handouts, authors' notes, and test questions for each chapter. The Instructor's Resource Manual also contains a list of five optional lectures and four appendices which the instructor may wish to include in the lectures.

Additional References

Sources of additional references on the chapter topic are included to supplement information presented in the videotapes or text. These additional references will assist the instructor in mastering topics presented to students.

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SELECTING AN ADEQUATE DIET

General Instructions

Factors to consider in planning a nutritionally adequate diet are the focus of this unit. Resources used to measure dietary adequacy, their development, and intended usage are explored. In addition, the role of industry in changing the composition of available foodstuffs to better meet the nutrient needs of Americans is discussed.

In this tape, refined foods are referred to as being less desirable than unrefined ones. This should not be construed to mean that all food processing is undesirable. Processing is a broad term that includes canning, freezing, and drying, as well as refining. These processes are vital for food preservation and they impact on the available food supply in the United States. Some nutrient loss does occur in food processing, but this small loss is preferable to the extreme waste that would occur if there were no means of food preservation.

Objectives

Upon completion of this lesson which includes text assignments, video viewing, and study guide activities, the participant should be able to:

1. Identify four physiological factors that influence nutrient needs.
2. Differentiate between the Recommended Dietary Allowances (RDAs) and nutrient requirements.
3. Recognize that RDA levels change for different age/sex groups.
4. Specify at least three intended uses of the Recommended Dietary Allowances.
5. Identify the primary nutrients contributed by each of the Basic Four Food Groups.
6. State several limitations in using the Basic Four as a food guide.
7. Distinguish between enrichment and fortification as two examples of nutrient additions to the food supply.
8. Name the four enrichment nutrients found in several grains and cereal products.
9. List four examples of nutrient fortification.
10. Discuss at least two controversial issues that relate to nutrient fortification.

Instructor's Information
The video refers to the original Basic Food Group plan and omits the additional food group that has recently been included in the USDA's Modified Daily Food Guide. Participants should be informed that the Basic Four Food Groups are still the standard around which nutritious diets are planned. This additional group of "other" foods contains mainly foods that are high in calories but low in nutrients. Foods from this group should be eaten in moderation.

Listed below are suggested references which will provide the participant with more clarification of the Daily Food Guide.

1. Building a Better Diet. USDA Program Aid 1241 (Limited copies are available from the North Carolina Department of Public Instruction, Division of Child Nutrition.)

2. Food. USDA Home and Garden Bulletin 228 (This publication is no longer available for publication but may be reproduced.)

3. Guide to Good Eating. National Dairy Food and Nutrition Council (B-164)

Guidance From Instructor's Resource Manual
In preparing the lesson plan for Chapter 2, "First Facts: Foods," and Chapter 3, "First Facts: Nutrient Needs and Nutrition Surveys," a review of the lesson concepts, lecture outline, and authors' notes, pages 15-22 and 23-31 in the Instructor's Resource Manual is suggested. Transparencies and handouts for Chapters 2 and 3 are located in Appendix D of the resource manual.

Suggested Activity
The text assignments (Chapter 3, pages 54-55) refer to the National School Lunch Program as a means of providing nutritious meals to children. This would be a good opportunity to give teachers an overview of the nutrition programs available in the school system. The history, purpose, benefits, and a brief explanation of some program regulations are examples of information that may be of interest.

Additional References
References for Chapters 2 and 3 are located on pages 32 and 56 of Nutrition: Concepts and Controversies. References for Controversy 3 are listed in Appendix M, pages 113-114.

Additional references specifically for nutrition assessment can be found in Appendix D, page D-14 of the Instructor's Resource Manual. References for the Dietary Guidelines and food patterns are also in Appendix D of the resource manual, pages D-23 and D-24.

NUTRITION IN PREGNANCY

General Instructions

The importance of good nutrition during pregnancy is evident from the fact that fetal tissue is formed from nutrients that originate in the mother's diet, past or present. A woman who is well nourished at the time of conception, and whose diet during pregnancy contains the quantity and quality of nutrients needed to meet her increased requirements, is likely to have fewer complications during pregnancy and to deliver a healthier infant than a woman whose nutritional status is marginal or inadequate.

The lesson focuses on the importance of a nutritionally adequate diet prior to and during pregnancy. The nutrient requirements of both mother and developing child are examined. Many technical terms and phrases are used throughout the videotape; an explanation of terms may be necessary.

The videotape is approximately one hour in length. It may be beneficial to stop the film midway and allow comments and questions from the participants. At the conclusion of the videotape, the instructor should allow time for group discussion of the concepts presented and strategies for integrating the concepts into existing curricula.

Objectives

Upon completion of this lesson, which includes text assignments, video viewing, and study guide activities, the participant should be able to:

1. Recognize that nutrition is one of many factors which influence the outcome of pregnancy.
2. Specify the range of recommended weight gain during pregnancy for women of normal pre-pregnancy weight.
3. Identify the three physiological stages of pregnancy.
4. Assess the consequences of malnutrition on each developmental stage.
5. Indicate the nutrients which have increased importance during pregnancy.
6. Discuss problems which may arise during pregnancy from inadequate intake of several specified nutrients.
7. Identify one group of individuals who may be particularly susceptible to the stresses of pregnancy.

Instructor's Information

Review the Recommended Dietary Allowances (RDA), especially the recommendations for iron and calcium, during pregnancy and lactation. The RDA table is located inside the front cover of Nutrition: Concepts and Controversies.

The following resources may be beneficial to further explore the concepts from this unit:

1. Invite an obstetrician and/or nutritionist as a guest speaker for the class.

2. Investigate the programs which serve pregnant women by way of education and nutritional supplements (Women, Infant, and Children (WIC) Supplemental Program and March of Dimes).

3. Invite a representative from the local health department to discuss the services available to pregnant women and especially for the pregnant adolescent.

Guidance From Instructor's Resource Manual

Prior to preparing the lesson plan, it may be helpful to review pages 145 - 157 of the *Instructor's Resource Manual*. Included in this section is a unit overview, a lecture outline, and authors' notes. In addition, transparencies and handouts for this unit are located in Appendix D of the *Instructor's Resource Manual*.

Glossary

Before viewing the videotape, review the following terms:

Amniotic Fluid	- The fluid surrounding the fetus within the uterus.
Differentiation	- Development of cells into more specialized forms.
Edema	- An excessive accumulation of fluid in the tissues, swelling.
Fallopian Tubes	- Tubes along which the ovum travels in the passage from the ovary to the uterus, usual site of fertilization.
Gestation	- The duration of the development of the infant from conception to birth.
Interstitial Fluid	- Fluid between the cells.
Low Birth Weight	- Infant weighing 2,500 gms. (5.5 lbs.) or less at birth.
Peristaltic Motion	- Contraction and relaxation of the muscle fibers along the GI tract which moves food through the tract.
Toxemia	- A pathological condition which may occur in pregnancy which is characterized by generalized edema, high blood pressure, and protein in the urine.

Additional References

References for Chapter 13, "Mother and Newborn Infant," are on pages 401-403 of *Nutrition: Concepts and Controversies*.

Additional references for pregnancy and lactation are located in Appendix D, pages D-28 through D-31, of the *Instructor's Resource Manual*.

NUTRITION IN INFANCY

General Instructions

The first year of life is one of remarkable change. During this intensive period of growth, nutrient needs are greater, per unit of body size, than at any other age. In his first 12 months, an infant will likely triple his weight and increase his length by 50 percent.

As a result of new technologies, many changes in infant feeding practices have occurred. Breast feeding has declined, while the use of commercially available infant formulas has increased. These formulas have provided an acceptable source of nutrition for the infant.

This unit examines advantages and disadvantages of current infant feeding practices. In addition, nutrient requirements and feeding patterns are discussed. Several technical terms used throughout the videotape may be unfamiliar to the participants. It will be helpful to review the terms in the glossary of Chapter 13, as well as the terms provided in the Instructor's Information section of this manual. Due to the length of the videotape, it may be beneficial to pause midway and allow comments and questions from participants.

The videotape refers to a chart comparing the composition of human and cow's milk. This chart has been provided for reproduction to be distributed to each participant.

Objectives

Upon completion of this lesson, which includes text assignments, video viewing, and study guide activities, the participant should be able to:

1. Indicate the nutrients that should be increased to meet nutritional needs during lactation.
2. Evaluate the recommended daily caloric increase for lactating women.
3. Relate increased nutrient requirements to specific recommendations for increasing certain foods during lactation.
4. List 4 benefits to both the mother and infant that may be derived from lactation.
5. Name the clear liquid derived from human milk which contributes immunity to the infant.
6. Discuss human and cow's milk with respect to their carbohydrate, protein, and fat content.
7. Compare the infant's ability to digest the protein in both cow's and human milk.

8. Identify two fat-soluble vitamins which should be provided to the infant in supplemental form because they are not supplied in adequate amounts in breast milk.

9. Specify the appropriate age for the introduction of solid foods and high protein foods into the infant's diet.

10. List three nutrients which, according to surveys, have been shown to be inadequate in the diets of children under age three.

11. Describe four characteristics which influence food acceptance by children.

12. Identify three adult health conditions which may be associated with patterns of eating established during childhood.

Instructor's Information

Prior to viewing the videotape, a review of the following terms may be helpful.

Soy Milk	- Infant formula with protein contributed by soy isolates rather than milk, used primarily for infants who are allergic to milk.
Wet Nurse	- A lactating woman who is breast feeding an infant in place of the mother.
Whey	- The watery part of coagulated milk.
Beriberi	- A deficiency disease caused by inadequate intake of thiamin. Infantile beriberi is most frequently found in children between 2 and 5 months of age.
Curd	- The thick, casein-rich portion of coagulated milk.
FDA	- Food and Drug Administration, a sub-unit within the Department of Health and Human Services, responsible for setting standards and enforcing regulations concerning the processing and selling of certain food products.
Immunity	- The body's resistance to the effects of infectious organisms.
Junior Foods	- Commercially prepared foods which provide textural variations.
Lactic Acid	- A substance produced by the lactobacillus microorganism from the milk sugar, lactose, which depresses the growth of pathogenic organisms in the gastrointestinal tract.
Ovulation	- The release of the ovum or egg from the ovary.
Osteoporosis	- A condition in which the density of the bone in the skeleton is diminished.

Lactobacillus Bifidus Factor - A nitrogen-containing carbohydrate found in human milk which provides a suitable medium for growth of the lactobacillus bifidus microorganism.

Guidance from Instructor's Resource Manual

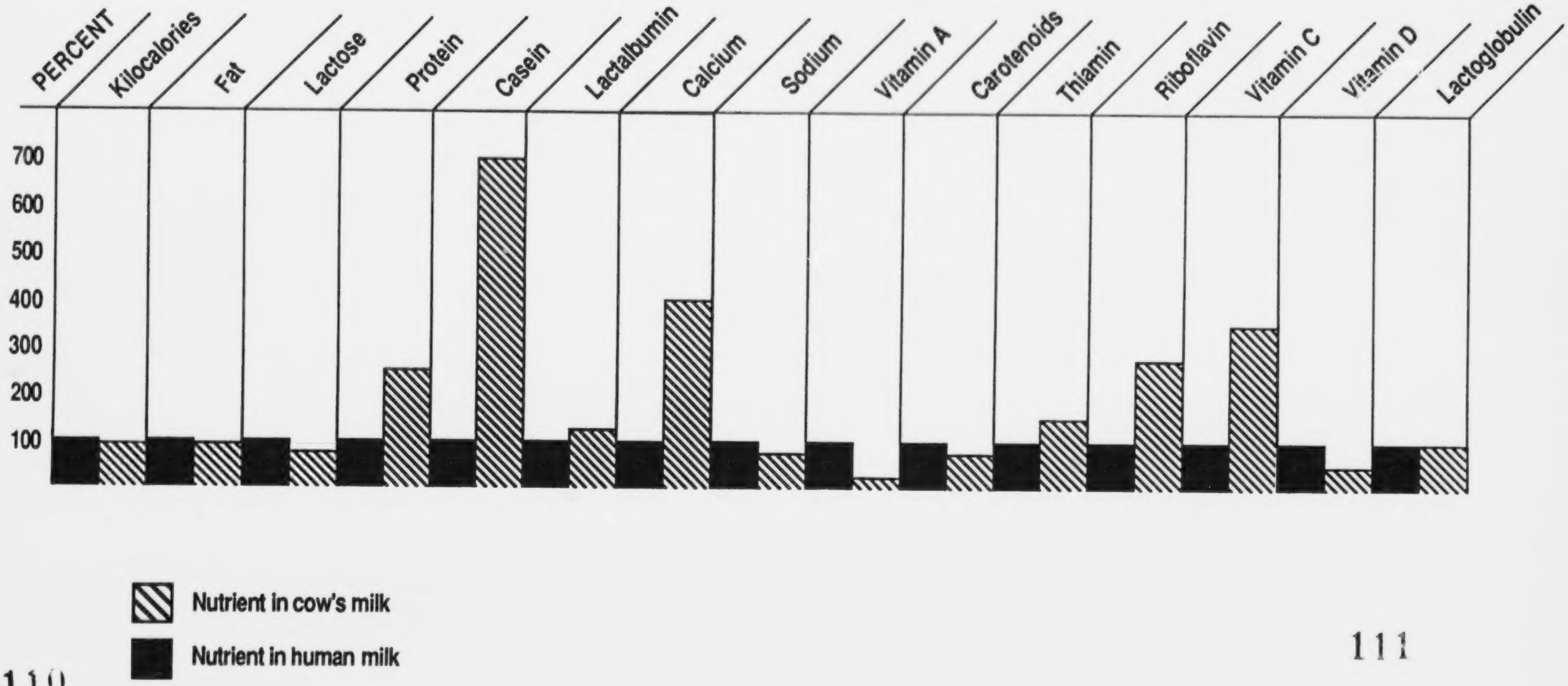
Prior to preparing the lesson, review the chapter overview, lecture outline, and authors' notes for Chapter 13, "Mother and Newborn Infant," and Chapter 14, "Infant, Child, and Teenager," pages 145-170 of the Instructor's Resource Manual. Transparencies and handouts for this lesson are located in Appendix D of the Instructor's Resource Manual.

Consider inviting, as a guest speaker, a specialist in pediatric nutrition (dietitian or physician) to discuss childhood food habits and nutritional needs during the growth years.

Additional References

References for Chapters 13 and 14 of Nutrition: Concepts and Controversies appear on pages 401-403 and pages 436-437 respectively. Additional references for infant nutrition are located in Appendix D of the Instructor's Resource Manual, pages D-28 through D-31. Also in the Instructor's Resource Manual are references for childhood nutrition and nutrition for teenagers. These topics are referenced in Appendix D, pages D-18 through D-20.

A COMPARISON OF THE NUTRIENT CONTENT OF HUMAN MILK AND COW'S MILK



NUTRITION IN AGING

General Instructions

Twenty-five million Americans are over the age of 65, and the proportion of the elderly in America is rapidly increasing. Perhaps this increase in the over age 65 population is due to better health habits, including good nutrition.

The aging process is accompanied by several changes, many of which are related to nutrition. It has been said that "aging affects one's nutritional needs, and one's level of nutrition can influence aging." The process of aging reflects a decline in the functional capacity of body tissues and in the basal metabolic rate (BMR). Several theories exist to explain why the aging process occurs, yet, due to the limited research in this area, the aging process is not well understood.

This unit examines the theories of aging, the aging process at the cellular level, and nutrient needs during the later years. Several factors influence the food habits and nutrient intake of elderly people; these factors are explored in the videotape.

Objectives

Upon completion of this lesson, which includes text assignment, video viewing, and study guide activities, the participant should be able to:

1. Discuss the relationship between nutrition and health in later years in life.
2. Relate the effects of a declining basal metabolic rate on energy needs of the elderly.
3. Name three theories which have been proposed to explain the physiological changes that occur during the aging process.
4. Relate five physiological changes that frequently occur with aging to changes in food intake among the elderly.
5. Identify three factors which may be related to the development of osteoporosis.
6. Specify the approximate percentage of the elderly in the U. S. who may be osteoporotic.
7. Relate psychosocial characteristics of the lifestyles of many elderly individuals to their dietary intake.
8. Identify groups of foods which are often under represented in the diets of the elderly.
9. Differentiate between the goals of the Congregate Meal Program and those of the Meals-On-Wheels Program.

10. Specify the criteria for eligibility for the elderly to participate in food assistance programs.

11. Recognize that food habits of the elderly are not inflexible but may be modified by appropriate nutrition information.

Instructor's Information

Representatives from local nutrition programs for the elderly may be willing to visit the class to discuss program eligibility, management, and participation.

Glossary

The following terms are used in the videotape. A review of the terms may be helpful prior to viewing this unit.

Epidemiological Studies	- Studies which examine the incidence and distribution of a disease on a population. Usually a large number of people are studied for an extended period.
Estrogen	- One of the female sex hormones.
Free Radical	- A small unstable fragment of a molecule which can cause destructive changes in the cell.
Ozone	- Oxygen in the form of O-3.

Guidance From Instructor's Manual

The chapter overview, lecture outline, and authors' notes for Chapter 15, "The Later Years," appear on pages 171-180 of the Instructor's Resource Manual. A review of these chapter materials may be helpful in preparing lesson plans. The transparencies and handouts for Chapter 15 are located in Appendix D of the Instructor's Resource Manual.

Additional References

Review Controversy 15, "Alcohol and Nutrition," pages 410 - 475 of Nutrition: Concepts and Controversies. References for Controversy 15 are located in Appendix M, page 119 of the text. References for Chapter 15, "The Later Years," are located on pages 468-469.

Additional references for nutrition and aging are located in Appendix D of the Instructor's Resource Manual, pages D-27 and D-28. References for nutrition and alcoholism and nutrition and disease are provided on pages D-13, D-15 through D-17, D-26 and D-31 through D-32 of the manual.

CARBOHYDRATES

General Instructions

Carbohydrates provide an important source of fuel for the body. Yet, because they are the class of nutrients most associated with weight gain, many weight conscious individuals exclude these important nutrients from their diets.

This lesson is structured around the low-carbohydrate diet as a means of weight reduction. Several controversial issues are introduced. In addition, the vital role that carbohydrates play in meeting the energy needs of the cells is examined.

Much technical information is presented in the videotape. The participants should be informed, prior to viewing the videotape, that the concepts are presented quite rapidly. Participants should be advised not to copy the structural formulas that are shown, nor attempt to learn them. The chemical formulas are used in the videotapes as visual aids to explain the different carbohydrates. If further reference to these formulas is desired, examples are located in the Instructor's Information section of this unit.

Carbohydrate digestion is not covered in the videotape, but is included in the reading assignments. This concept should not be addressed in this lesson, instead, it should be reserved for the lesson on "Energy."

Objectives

Upon completion of this lesson, which includes text assignment, video viewing, and study guide activities, the participant should be able to:

1. Name the primary function of carbohydrates.

2. Associate low-carbohydrate diets with an increase in fat utilization and accumulation of ketones.

3. Recognize that excretion of accumulated ketones causes increased sodium excretion and water loss.

4. Recognize that the weight loss which accompanies a low-carbohydrate diet is due to urinary loss of body fluid.

5. Discuss three harmful effects that may result from a low-carbohydrate diet.

6. List the origins and functions of four commonly known members of the carbohydrate family.

7. Differentiate among monosaccharides, disaccharides, and polysaccharides with regard to the number of simple sugar units included in the structure of each.

8. Name two examples of monosaccharides, disaccharides, and polysaccharides.

9. Identify the most abundant carbohydrate in the body.

10. Identify the raw materials used by plants for synthesis of glucose.

11. Recognize that photosynthesis demonstrates the most fundamental interdependence between plants and animals.

12. Distinguish glucose as the major fuel source for body tissues, especially in the central nervous system.

13. Recognize that most ingested carbohydrates are converted to glucose in the body.

14. List the parts of plants that are likely to be rich in carbohydrates.

15. Compare foods of plant and animal origin with regard to their carbohydrate content.

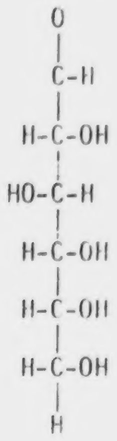
16. List two forms in which the body may store glucose not needed immediately as an energy source.

17. Recognize that cultural groups differ with regard to the proportion of total calories in the diet provided by carbohydrates.

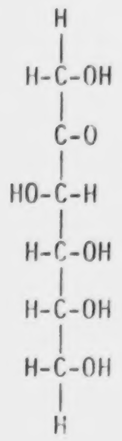
18. List the functions of cellulose in plants.

Instructor's Information

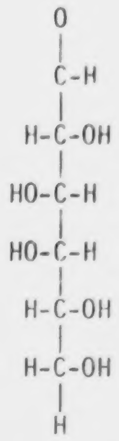
Refer to Chapter 4 of the Instructor's Resource Manual. The chemical formulas for the monosaccharides discussed in this chapter are as follows:



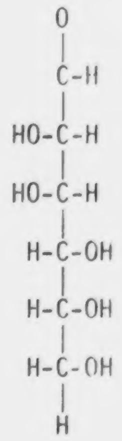
Glucose



Fructose



Galactose



Mannose

Guidance From Instructor's Manual

Prior to planning the lesson, refer to the lesson overview, lecture outline, and authors' notes for Chapter 4, "The Carbohydrates: Sugar, Starch, Fiber," pages 33-44. Controversies 4 and 11, pages 87-91, and 352-355, will also provide additional resources for this unit. Transparencies and handouts for Chapter 4 are located in Appendix D of the Instructor's Resource Manual.

Additional References

Supplementary references for this lesson are listed on pages 85-86 of *Nutrition: Concepts and Controversies*. Controversy notes for Controversies 4 and 11 are located in Appendix M, pages 114 and 117 of the text.

Additional references for carbohydrates appear in Appendix D, pages D-17 and D-18 of the *Instructor's Resource Manual*. Food additives are also referenced on pages D-12 and D-13.

LIPIDS

General Instructions

This lesson focuses on lipids as a class of nutrients. Included in the unit on lipids are their chemical characteristics, composition, and functions. The types of lipids in foods and in the body are identified and described.

The lesson also examines the role of lipids in the development of cardiovascular disease. Risk factors, both dietary and non-dietary, are identified. In addition, dietary recommendations for the prevention of heart disease are included.

Several technical terms are used in the videotape. Participants should be informed that these terms and their definitions are included in the Course Outline. In addition, they should be reassured that adequate time will be provided for discussion and clarification of terms and concepts at the conclusion of the videotape.

Again, chemical formulas are used as visual aids. As in previous lessons, participants should not be held responsible for identifying the formulas. Should further reference to the formulas be desired, examples are located in the Instructor's Information section of this unit.

The videotape refers to two charts, (1) Cholesterol Content of Foods and (2) Fatty Acid Composition of Foods. These charts are located in the Appendix of Nutrition: Concepts and Controversies, pages D-18 through D-25.

Objectives

Upon completion of this lesson, which includes text assignments, video viewing and study guide activities, the participant should be able to:

1. Explain the relationship between dietary lipids and cardiovascular disease.
2. Define atherosclerosis as a condition characterized by fat deposits, called plaques, inside arterial walls.
3. Recognize that cholesterol plays many important roles in the body and is synthesized by the body.
4. Specify that a strong correlation exists between the level of blood cholesterol and the incidence of atherosclerosis.
5. Describe the correlation that exists between the level of blood cholesterol and dietary levels of cholesterol and/or saturated fats.
6. Identify animal fats as a source of cholesterol.
7. Specify foods which are particularly rich in cholesterol.

8. Recognize the controversial role of saturated fat and cholesterol in the development of atherosclerosis.

9. Identify vegetable fats as the major source of polyunsaturated fatty acids.

10. Name six non-dietary risk factors associated with atherosclerosis.

11. State the recommended dietary modifications for the prevention of heart disease.

12. Describe lipids as a nutrient class.

13. Discriminate among lipids, carbohydrates, and proteins with respect to their energy values.

14. Identify fatty acids as the building blocks of certain important members of the lipid family.

15. Associate the fluidity of various lipids with their chain length and degree of saturation of the component fatty acids.

16. Differentiate between saturated and unsaturated fatty acids.

17. Define hydrogenation in relation to dietary fats.

18. Define polyunsaturated fatty acids with regard to the number of double bonds in the carbon chain.

19. Recognize that animal and vegetable fats are made up of both saturated and unsaturated fatty acids and specify which predominate in animal fat and which in vegetable fat.

20. Name two lipids that are rich in polyunsaturated fatty acids.

21. Recognize that unsaturated fatty acids are structural components of cell membranes.

22. Name the fatty acid which is considered a dietary essential.

23. Compare linoleic, linolenic, and arachidonic acids with regard to the number of double bonds in their carbon chains.

24. Associate peroxidation of fats with rancidity.

25. Identify vitamin E as an antioxidant.

26. List five substances that are classified as lipids.

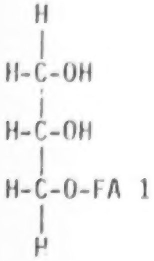
27. Differentiate among monoglycerides, diglycerides, and triglycerides with regard to the number of fatty acids contained in each.

28. Specify the major role of lipoproteins in the body.

29. Compare the energy value of a molecule of glucose with a molecule of a fatty acid.

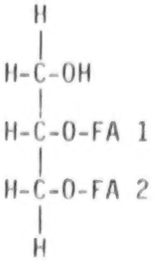
30. Explain how the energy value of glucose and fatty acid is related to the hydrogen and oxygen ratio of each.

Instructor's Information
Chemical formulas for glycerides are as follows: (FA represents a fatty acid)



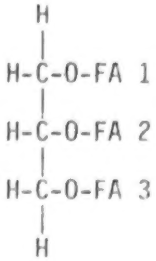
$$\begin{array}{l} \text{H} \\ | \\ \text{H-C-OH} \\ | \\ \text{H-C-OH} \\ | \\ \text{H-C-O-FA 1} \\ | \\ \text{H} \end{array}$$

Monoglyceride



$$\begin{array}{l} \text{H} \\ | \\ \text{H-C-OH} \\ | \\ \text{H-C-O-FA 1} \\ | \\ \text{H-C-O-FA 2} \\ | \\ \text{H} \end{array}$$

Diglyceride



$$\begin{array}{l} \text{H} \\ | \\ \text{H-C-O-FA 1} \\ | \\ \text{H-C-O-FA 2} \\ | \\ \text{H-C-O-FA 3} \\ | \\ \text{H} \end{array}$$

Mixed Triglyceride

Guidance From Instructor's Manual
Prior to preparing the lesson plan, review the chapter overview, lecture outline, and authors' notes for Chapter 5, "The Lipids: Fats and Oils," pages 45-54 of the Instructor's Resource Manual. Transparencies and handouts for this lesson are located in Appendix D of the manual. It may also be beneficial to read Controversy 5, "Diet and Heart Disease," pages 114-121 of Nutrition: Concepts and Controversies.

Additional References
Supplementary references for Chapter 5 are listed on page 113 of Nutrition: Concepts and Controversies. Controversy notes for Controversy 5 are located in Appendix M, pages 114-115 of the text.

Additional references for lipids appear in the Instructor's Resource Manual, Appendix D, pages D-22 and D-23. References for lipids and heart disease are also in the resource manual, pages D-15 and D-16.

PROTEINS

General Instructions

Proteins are found in every living cell of the body, and they are essential to the reactions that make life possible. Proteins are the most expensive nutrients in terms of their cost and their human requirement. While the importance of protein in the body cannot be overestimated, its importance in the American diet is often over-exaggerated. In this unit, the role of protein in the body, dietary protein requirement, and food sources to meet protein needs will be examined.

The videotape introduces participants to the issue of world protein requirements. This issue is presented from a rather biased perspective as it suggests that changes in protein consumption in the United States could help alleviate world hunger. Even though it is important to become aware of the disproportionately large consumption of animal protein in the United States, the solution to the problem of malnutrition is hardly as simple as decreasing animal protein intake in affluent countries.

Protein digestion is not addressed in the videotape, but it is included in the text assignment. This concept should not be addressed in this lesson, instead, it should be reserved for the lesson "Energy." Digestion of all nutrients will be presented in the videotape titled "Energy."

Objectives

Upon completion of this lesson, which includes text assignments, video viewing, and study guide activities, the participant should be able to:

1. Compare the importance of protein in the United States with that in developing countries on the basis of per capita consumption in relation to the RDA.

2. Assess the importance of protein in the United States with that in developing countries on the basis of incidence of protein-calorie malnutrition (PCM).

3. Evaluate the importance of protein in the United States with that in developing countries on the basis of the relative contribution of animal versus plant protein sources in the diet.

4. Compare the proportion of grain consumed directly by humans versus the proportion fed to animals and converted to flesh before being consumed by humans in the United States and in developing countries.

5. Distinguish between kwashiorkor and marasmus.

6. Name the three chemical elements that are found in carbohydrates, proteins, and lipids.

7. Identify the element which distinguishes protein from carbohydrate and lipid.

8. Recognize that amino acids are the building blocks of protein molecules.

9. Specify that there are 20 different amino acids commonly found in living organisms.

10. Distinguish between essential amino acids and nonessential amino acids.

11. List 5 body functions in which protein plays a major role.

12. Describe the role of enzymes in chemical reactions within living cells.

13. Recognize that all body proteins are continually being broken down and resynthesized and that this process requires amino acids to be continually replenished by the diet.

Guidance from Instructor's Resource Manual
The overview, lecture outline, and authors' notes for Chapter 6, "The Proteins and Amino Acids," are located on pages 55-56 of the Instructor's Resource Manual. Transparencies and handouts for Chapter 6 are located in Appendix D of the manual.

Additional References
Supplemental references for protein are listed on page 148 of Nutrition: Concepts and Controversies. Controversy notes for Controversy 7, "Do Athletes Need A Special Diet?" are located in Appendix M, page 116 of the text.

Additional references for nutrition and athletic performance are located in Appendix D of the Instructor's Resource Manual, pages D-16 and D-17.

ENERGY

General Instructions

This lesson describes the steps which are involved in the conversion of food to energy. When food enters the body, it is broken down, transported to the cells, and eventually used to fuel body processes. The lesson focuses on digestion, absorption, transportation, and utilization of nutrients as well as energy expenditure by the body and energy values of the nutrients.

The videotape introduces several scientific terms and processes. In several instances, the digestive and absorptive processes are quite complex and may require additional clarification. A section in the Course Outline is devoted to simplifying the digestive and absorptive processes; this section will provide a useful overview of the unit. As in previous lessons, participants should not be responsible for technical concepts or chemical processes.

Digestion of carbohydrates, proteins, and lipids is presented in the text assignments for these nutrients. Additional information on lipid digestion is provided for the instructor in the Instructor's Information section.

The videotape lasts approximately one hour. If possible, it may be beneficial to stop the tape about midway to allow for questions and discussion.

Objectives

Upon completion of this lesson, which includes text assignment, video viewing, and study guide activities, the participant should be able to:

1. Associate the energy received from dietary carbohydrates, proteins, and lipids as the source of energy for the body.
2. Recognize that carbohydrates, proteins, and lipids must be broken down (digested) into their smallest components before being absorbed in the body.
3. Define the three categories of energy expenditure in the body.
4. Conclude that food, which contains energy, is digested into small molecules, absorbed, and transported to the cells where energy is ultimately used.
5. Identify the molecule which captures the energy released from nutrients.
6. Define ATP as the fuel source for cellular "work."
7. Distinguish between calorie and Calorie (kilocalorie) in terms of the amount of energy each represents.
8. Compare the physiological fuel values of carbohydrates, proteins, and lipids.

9. Associate excess energy (caloric) intake with fat storage.

10. Identify calorimetry as the measurement of energy expended by the body.

11. Differentiate between direct and indirect measures of energy expenditure, by the body.

12. List the factors which influence the rate of basal metabolism.

13. Describe how various factors influence the rate of basal metabolism.

Instructor's Information

Mechanical digestion of lipids begins in the stomach. Here, lipids are formed into a coarse emulsion. There is no absorption of lipids in the stomach. In the upper small intestine, the coarse emulsion mixes with pancreatic enzymes and bile. The lipolytic enzymes secreted by the pancreas include pancreatic lipase and cholesterol esterase. Pancreatic lipase acts on the water-oil interface of the coarse emulsion to hydrolyze the triglycerides, liberating both monoglycerides and fatty acids into the aqueous medium in the intestines. Cholesterol is hydrolyzed by cholesterol esterase.

Although these compounds have been "released" from the large particles in the coarse emulsion, practically no absorption would take place from the aqueous medium in the intestinal lumen without the presence of bile. In addition to its role in emulsification of fat, bile is also found in the intestinal lumen as a mixture of bile salts, phospholipids, and cholesterol in the form of micelles. These spherical aggregates are most stable and much smaller in diameter than the coarse emulsion droplets. Micelles contain a large proportion of compounds that have both polar and nonpolar regions. The polar ends are directed toward the aqueous medium and the nonpolar ends aggregrate to form the core of the micelle. Bile, in the form of micelles, can solubilize the end-products of lipid hydrolysis by the pancreatic enzymes, including monoglycerides, fatty acids, phospholipids, and cholesterol. The small aggregates of lipid, referred to as mixed micelles, can then make contact with the brush border of the small intestine. Lipid absorption takes place either by movement of the mixed micelle across the brush border or by movement of the solubilized lipids into the cell with return of the bile salts to the intestinal lumen. Once lipid absorption has occurred, the bile salts return to the aqueous phase in the intestinal lumen to solubilize more lipids. A large proportion of bile salts are absorbed in the lower part of the small intestine, then they are returned to the liver via the portal vein.

Guidance from the Instructor's Manual

Transparencies and handouts for this unit are located in Appendix D of the Instructor's Resource Manual. The supplementary materials are included in the sections on protein, carbohydrate, and lipid.

Additional References

Additional references for digestion and absorption are located in Appendix D of the Instructor's Resource Manual, page D-22.

WORLD FOOD I

General Instructions

Today, many people assume that malnutrition, or undernutrition, exists only in isolated sections of less developed countries. Yet, malnutrition can be found in every nation, regardless of its economy or available natural resources. Whether a nutritional deficiency is caused by an inadequate dietary intake or by poor utilization of nutrients, the basic sequence of change in body metabolism is similar.

In the first unit on world food, participants are introduced to methods of nutritional assessment at different stages in the development of a nutrient deficiency, and to the practicality of using each of these methods in field studies. Although the extreme clinical symptoms of kwashiorkor are seldom encountered, the incidence of protein-calorie malnutrition (PCM) in children is widespread. The effect of infectious disease and of specific nutrient deficiencies on malnutrition in children is discussed.

Objectives

Upon completion of this lesson, which includes text assignment, video viewing, and study guide activities, the participant should be able to:

1. Differentiate between primary nutritional deficiencies and secondary nutritional deficiencies.
2. Distinguish between a biochemical lesion and an anatomical lesion.
3. Associate biochemical tests for nutrient status with the examination of certain tissue or fluids.
4. Recognize that the presence of anatomical lesions is determined by a clinical examination.
5. Identify that anthropometric measurements are most valuable in evaluating nutritional status of children.
6. Recognize that dietary evaluation is only a single indicator of nutritional status.
7. Compare kwashiorkor and marasmus as forms of protein-calorie malnutrition (PCM).
8. List reasons that children are particularly susceptible to PCM.
9. Evaluate the interaction between malnutrition and disease.
10. Identify the major symptoms exhibited in vitamin deficiencies.

Instructor's Information

The information included in this unit is not addressed by a specific chapter in Nutrition: Concepts and Controversies. The world food situation is however, the subject of Controversy 6, "World Hunger." Protein-calorie malnutrition (PCM) is also described in Chapter 6, "The Proteins and Aminc Acids," on pages 144-146.

Additional References

Controversy notes for Controversy 6 are listed in Appendix M, pages 115-116 of the text. Additional references for world hunger are listed in Appendix D of the Instructor's Resource Manual, D-37 and D-38.

WORLD FOOD II

General Instructions

Although it has been suggested that a decrease in the consumption of animal products in the United States and Western Europe would help alleviate the world food crisis, many other factors require consideration. In this unit, the complexity of the world food problem is addressed.

Leading authorities on international food issues present the unit topics. The contribution of birth and death rates to population growth is examined by Dr. Ken Wilkenson. Food is only one of the limiting resources in a developing nation, and Dr. Rustum Roy examines the disproportionate use of the world's resources by a few wealthy nations. The distribution of surplus food from the United States to less developed nations is explored by Dr. Carole Christopher. The role of agriculture in increasing food resources and the effectiveness of the Green Revolution is presented by Dr. Mackenzie.

Objectives

Upon completion of this lesson, which includes text assignment, video viewing, and study guide activities, the participant should be able to:

1. Specify the percent of the world's population which is undernourished.
2. Define exponential growth in terms of population.
3. Recognize that the world's food shortage involves problems other than overpopulation.
4. Recognize that, on a worldwide basis, both birth and death rates have fallen.
5. Briefly define the Malthusian solution as it relates to population growth.
6. Recognize that the U. S. utilizes a disproportionate share of much of the world's resources, including food.
7. Discuss how over-reliance on cash crops affects the nutritional well-being of less developed nations.
8. Explain the hypothesized effects of the "green revolution" on the world food problem.
9. Define the "lifeboat" and "triage" approaches to the world food problem.

Instructor's Information

This subject is not addressed by a separate chapter in *Nutrition: Concepts and Controversies*. The world food situation is the topic of Controversy 6, "World Hunger."

Ask participants to review and bring to class current articles and pictures related to world hunger. These materials may be helpful toward generating class discussion about the influence of the Green Revolution and the Malthusian principle on world food shortages.

Additional References

Controversy notes for Controversy 6, "World Hunger" are located in Appendix M, pages 115-116, of Nutrition: Concepts and Controversies. Additional references for world hunger are listed in Appendix D of the Instructor's Resource Manual, pages D-37 and D-38.

VITAMINS I

General Information

Vitamins are perhaps the most controversial nutrients. Vitamins are also responsible for much of the public's heightened interest in nutrition and health. Unfortunately, much of this new interest surrounds the popular belief that vitamins are a "cure-all."

As the videotape begins, a television viewer is bombarded with a deluge of vitamin commercials promising preventive and curative features. High-pressure, persuasive vitamin advertising is analyzed by the program narrator. Vitamin claims, based solely on speculation, are also examined in this unit. The vitamin claims are evaluated on both their non-scientific basis and their ability to sell a product, specifically vitamins.

This lesson disputes vitamin myths, and focuses on the irrefutable facts about vitamins. Vitamin functions, deficiency syndromes, food sources, and nomenclature are discussed in detail. Special emphasis is given to the water-soluble vitamins; fat-soluble vitamins are discussed in greater detail in the next videotape.

Objectives

Upon completion of this lesson, which includes text assignment, video viewing, and study guide activities, the participant should be able to:

1. Describe the historical basis for the current belief held by many vitamin enthusiasts that vitamins are a cure-all.
2. Indicate the differences between vitamins and other nutrients.
3. Select true from false vitamin claims.
4. Identify vitamins that cause toxic reactions when taken in megadosages.
5. Name two speculative claims in vitamin C knowledge and research.
6. List the water-soluble vitamins.
7. List the fat-soluble vitamins.
8. Discuss the three effects of solubility on vitamins.
9. Associate the water-soluble vitamins with roles as co-enzymes in cellular reactions.
10. Describe four characteristics of B-complex vitamins.
11. Discuss the functions of vitamin C.
12. List two effects of consuming vitamin C in megadose levels over a period of time.

13. Distinguish between the anemias caused by vitamin B-12 and folacin deficiency.

Instructor's Information

Before viewing the videotape, review the following terms:

Capillary	- A minute blood vessel between small arteries and veins.
Carbon Skeleton	- The arrangement of connected carbon atoms which provide the structural basis for molecules such as amino acids or carbohydrates.
Co-enzyme	- A small molecule that works with an enzyme to promote the enzyme's activity.
Degeneration	- Deterioration of healthy functioning.
Hemorrhage	- The escape of blood from a ruptured blood vessel.
Hydroxyl Group	- An oxygen atom attached to a hydrogen atom (OH).
Hydroxylation	- The process of adding a hydroxyl group to a molecule.
Intrinsic Factor	- A protein substance which attaches to Vitamin B-12 and carries it from the stomach to the walls of the intestines.
Macrocyte	- A very large red blood cell.
Megaloblast	- An immature red blood cell.
Myelin Coating	- A substance surrounding nerve fibers in the body.
Toxicity	- A condition of being toxic.

Guidance From Instructor's Resource Manual

Refer to the Instructor's Resource Manual, pages 91-107, prior to preparing lesson plans. Included in this section is the lesson overview, lecture outline, and authors' notes for chapter 9, "The Vitamins." Transparencies and handouts for chapter 9 are located in Appendix D of the resource manual.

Additional References

For references to this topic, refer to pages 256-257 of Nutrition: Concepts and Controversies. Also, controversy notes for Controversy 9, "Vitamin B-6 Deficiency: How Common is It?" are located in Appendix M, pages 116-117 of the text. Additional references for vitamins are listed in Appendix D of the Instructor's Resource Manual, pages D-34 and D-35.

VITAMINS II

This videotape is a continuation of the unit on vitamins. Fat-soluble vitamins, their functions in the body, food sources, and deficiency syndromes are discussed. In addition, the effects of fat-soluble vitamin toxicities, which result from excessive reliance upon vitamin supplements, are explored.

Some complex concepts are included in this section on vitamins; these concepts may require further exploration by the group. Topics which may generate additional questions from the participants include determination of vitamin requirements, evaluation of vitamin claims, conditions under which vitamin deficiencies occur, and the appropriate use of vitamin supplements.

Symptoms of vitamin deficiencies will be briefly reviewed in the videotape. Some of the symptoms will require additional discussion, and participants should be reassured that adequate activities and discussion will follow to allow greater understanding of the topic.

Objectives

Upon completion of this lesson, which includes text assignments, video viewing, and study guide activities, the participant should be able to:

1. Recall the names of the vitamins that are classified as fat-soluble.
2. Name the two fat-soluble vitamins which are known to be toxic when ingested in excessive amounts.
3. Identify the major physiological function of each of the fat-soluble vitamins.
4. Specify the major deficiency symptoms of the fat-soluble vitamins.
5. Associate vitamin deficiency symptoms with vitamin functions in the body.
6. Describe the role of vitamin A in the synthesis of rhodopsin in the visual cycle.
7. Name the vitamin A precursor found in plants.
8. Identify vitamin D as the fat-soluble vitamin which can be synthesized from a precursor molecule found in the body.
9. Discuss the significance of vitamin D fortification of milk.
10. Explain the general procedures for determining the amounts of specific vitamins required to prevent deficiencies in humans.
11. Distinguish between single-blind studies and double-blind studies with respect to their appropriateness for validating vitamin claims.

12. Identify specific situations in which vitamin deficiencies may occur.

13. Describe how reliance upon highly processed foods influences the ability to obtain adequate amounts of vitamins from the diet.

Instructor's Information

Before viewing the videotape, review the following terms:

Antioxidant - A compound that protects other compounds from oxygen by reacting with oxygen itself.

Bile - A substance secreted by the liver which aids in the digestion of fats.

Coagulation - The process by which a blood clot is formed.

Epithelial Tissue - The layers of the body that serve as selective barriers to the environment. Examples include skin, respiratory lining, and gastrointestinal lining.

Gall Bladder - A reservoir for bile which is attached to the liver.

International Units - A measure of vitamin activity.

Keratinized - Tissue that has become excessively hard and dry.

Rancidity - Spoilage of fats characterized by an unpleasant odor, often resulting from oxidation.

Rods - Special cells in the retina of the eye which are very sensitive to light and allow vision in dim light.

Guidance from Instructor's Manual

Controversy 2, "Vitamin, Mineral, and Other Supplements" provides a helpful overview of the appropriate and inappropriate use of supplements. Controversy 2 is located on pages 33-37 of the text. Refer to the Instructor's Resource Manual for the lesson overview, lecture outline, and authors' notes for chapter 9, "The Vitamins." Transparencies and handouts for Chapter 9 are located in Appendix D of the Instructor's Resource Manual.

Additional References

Additional references for Chapter 9 appear on pages 256-257 of Nutrition: Concepts and Controversies. References for Controversy 2 are located in Appendix M, page 113 of the text.

MINERALS

At the present, minerals have the attention and focus of nutrition researchers much like vitamins did in the earlier part of the century. In fact, research into the role and requirements of mineral elements is one of the most exciting areas of nutritional science today. Minerals are required by the body in minute quantities, and while only 4 percent of the body's weight is composed of minerals, their functions as structural components and metabolic regulators are vital for the maintenance of life.

This lesson reviews the essential role of minerals in the human body, in plants, and in animals. The cycle through which minerals are introduced into the food supply is also described. Because microminerals are addressed only briefly, further exploration of these elements may be necessary through class discussions.

Objectives

Upon completion of this unit, which includes a text assignment, class presentations and study guide activities, the participant should be able to:

1. Differentiate between inorganic and organic sources of elements required for plant growth.
2. List three factors which influence the quantity of nutrients present in plants.
3. Discuss the consequences of having soil that is deficient in one or more of the elements needed by plants for optimal growth.
4. Identify three factors which determine the nutritional consequences of relying on plants grown in soil depleted of a particular element.
5. List the advantages and disadvantages of both inorganic and organic forms of fertilizer.
6. Compare the relative quantity of minerals required with the quantity of energy-yielding nutrients required by humans.
7. Distinguish between macrominerals and microminerals.
8. State two reasons why certain minerals may be deficient in some diets.
9. Associate the normal blood levels of minerals with the levels that produce deficiencies and toxicities.
10. Name the two main functions of minerals in the body.
11. Identify the roles of calcium, phosphorus, and fluorine in hard tissues.

12. Associate the role of iodine with the prevention of goiter.

13. Distinguish between minerals as enzyme components and minerals as enzyme co-factors.

Additional Information
As a means of generating discussion among the group, consider asking participants to collect articles, advertisements, and other lay materials regarding minerals and mineral supplements. Encourage participants to evaluate the materials presented.

It may be helpful to invite a local dietitian to answer questions about the role of minerals in disease prevention.

Guidance from Instructor's Resource Manual
Prior to formulating the lesson plan, review pages 109-123 of the Instructor's Resource Manual. The lesson overview, lecture outline, and authors' notes for Chapter 10, "Minerals and Water," are contained in this section. Transparencies and handouts for this chapter are located in Appendix D of the resource manual.

Additional References
References for Chapter 10, "Minerals and Vitamins" are located on pages 303-305 of Nutrition: Concepts and Controversies. Controversy notes for Controversy 10, "Nutrition and Premenstrual Syndrome," appear in Appendix M of the text, page 117.

Additional references for minerals are listed in Appendix D of the Instructor's Resource Manual, pages D-25 and D-35.

OBESITY AND DIETING

Obesity is the result of excessive amounts of adipose tissue being stored in the cells of the body. Obesity has come to be regarded as America's number one health and nutrition-related problem. It has been linked to the development of chronic conditions such as heart disease and diabetes.

Obesity in the United States is on the rise. Depending on the criteria used to define obesity, 8 to 15 percent of school age children are obese, 12 to 20 percent of adults are obese and an estimated 1/3 to 1/2 of persons above age 50 exceed their healthy weight by 20% or greater.

Americans are preoccupied with weight reduction. Each year, 50 million Americans spend 20 billion dollars in search of quick, easy weight loss programs. This figure exceeds 40 billion dollars annually if dietetic foods, health spas, appetite depressant drugs, special exercise gear, and other devices are calculated.

In this unit, the problem of energy balance is addressed. Specifically, the roles of exercise, behavior modification, and sensible diet, are discussed.

Objectives

Upon completion of this unit, which includes a text assignment, class presentations, and a study guide activity, the participant should be able to:

1. Define positive energy balance and negative energy balance in terms of their relative impact on weight status.
2. Identify the three uses of calories by the body.
3. Describe two theories of appetite control.
4. Recognize the risk of lifelong obesity.
5. Identify two traits that are generally characteristic of gimmick weight loss diets.
6. Describe two types of claims that surround gimmick weight loss diets.
7. List characteristics of a sensible weight reduction program.

Instructor's Information

To further explore the problems of obesity, a dietitian from a local health department may be available as a guest speaker to share with the group successful approaches to weight control. It may also be beneficial to invite a specialist in eating disorders to discuss the nutritional and psychological problems of anorexia nervosa and bulimia.

Guidance from Instructor's Resource Manual

Prior to preparing lesson plans, review Chapter 7, "Energy Balance: Feasting, Fasting, Loafing, Exercising," pages 67-77. Also, review Chapter 8, "Energy Balance: Overweight and Underweight," pages 79-89. Contained in these sections of the Instructor's Resource Manual, are the lesson overviews, lecture outlines, and authors' notes for Chapters 7 and 8. Transparencies and handouts for this unit are located in Appendix D of the resource manual.

Additional References

References for Chapters 7 and 8 are listed on pages 176-177 and 212-214 of Nutrition: Concepts and Controversies. Controversy notes for Controversy 8, "Bulimia and Anorexia Nervosa" are located in Appendix M, page 116, of the text.

Additional references for anorexia nervosa are located in Appendix D, page D-14, of the Instructor's Resource Manual. References for weight control are also listed in the Instructor's Resource Manual, Appendix D, pages D-36 and D-37.

The Nutrition Education and Training Program of the Division of Child Nutrition, North Carolina Department of Public Instruction is available to all individuals regardless of race, color, national origin, sex, age, religion or handicap. Persons who believe they have been denied equal opportunity for participation may write to the Secretary of Agriculture, Washington, D.C. 20250.